GE Healthcare

Voluson® i

Basic User Manual

English (English)



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GE imagination at work

Revision History

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Chapter 1

General

General Information of the Voluson® i

The Voluson® i is a professional Diagnostic Ultrasound System which transmits Ultrasound waves into the body tissues and forms images from the information contained within the received echoes.

The Voluson® i is an Active Diagnostic Medical Product belonging to Class IIa according to the MDD 93/42/EEC regulation for use on human patients.

The Voluson® i is developed and produced by the company GE Healthcare Austria GmbH & Co OG.

For more Information, please contact:

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Dear Valuable Customer,

We herewith would like to inform you that the American Institute of Ultrasound in Medicine (AIUM) advocates the responsible use of diagnostic ultrasound. The AIUM strongly discourages the non-medical use of ultrasound for psychosocial or entertainment purposes.

The use of either two-dimensional (2D) or three-dimensional (3D) ultrasound to only view the fetus, obtain a picture of the fetus or determine the fetal gender without a medical indication is inappropriate and contrary to responsible medical practice.

Although the general use of ultrasound for medical diagnosis is considered safe, ultrasound energy has the potential to produce biological effects. Ultrasound bioeffects may result from scanning for a prolonged period, inappropriate use of color or pulsed Doppler ultrasound without a medical indication, or excessive thermal or mechanical index settings (American Institute of Ultrasound in Medicine: Keepsake Fetal Imaging; 2005).

Thus ultrasound should be used in a prudent manner to provide medical benefit to the patient.

1.1 About this User Manual

- Read and understand all instructions in the Basic User Manual before attempting to use the Voluson® i .
- This Manual has to be used in connection with the Voluson® i .
- Keep this User Manual with the equipment at all times.
- All information contained in the Voluson® i User Manual is relevant.
- Periodically review the procedures for operation and safety precautions.



New company name:

GE Healthcare Austria GmbH & CO OG
Please be advised that the new company name will replace the old company name wherever used in the manual.



The screen graphics and illustrations in this manual are for illustrative purposes only and may be different from what is displayed on the screen or device.



All references to standards / regulations and their revisions are valid for the time of publication of the user manual.

1.2 Contacting GE Healthcare Ultrasound

For additional information or assistance, please contact your local distributor or the appropriate support resource listed on the following pages:

INTERNET	http://www.gehealthcare.com http://www.gehealthcare.com/usen/ultrasound/products/probe_care.html
Clinical Questions	For information in the United States, Canada, Mexico and parts of the Caribbean, call the Customer Answer Center Phone: (1) 800-682-5327 or (1) 262-524-5698 In other locations, contact your local Applications, Sales or Service Representative.
Service Questions	For service in the United States, call GE CARES Phone: (1) 800-437-1171 For service for compact products in the United States, call Phone: (1) 877-800-6776 In other locations, contact your local Service Representative.
Information Request	To request the latest GE Accessories catalog or equipment brochures in the United States, call the Response Center Phone: (1) 800-643-6439 In other locations, contact your local Applications, Sales or Service Representative.
Placing an Order	To order accessories, supplies or service parts in the United States, call the GE Healthcare Technologies Contact Center Phone: (1) 800-558-5102 In other locations, contact your local Applications, Sales or Service Representative.
ARGENTINA	GEME S.A. Miranda 5237 Buenos Aires - 1407 Phone: (1) 639-1619 Fax: (1) 567-2678
ASIA PACIFIC JAPAN	GE Healthcare Asia Pacific 4-7-127, Asahigaoka Hino-shi, Tokyo 191-8503 Japan Tel: +81 42 585 5111

AUSTRALIA NEW ZEALAND	GE Healthcare Australia & New Zealand Building 4B, 21 South St Rydalmere NSW 2116 Australia Tel: 1300 722 229 8 Tangihua Street Auckland 1010 New Zealand Tel: 0800 434 325
AUSTRIA	General Electric Austria GmbH Filiale GE Healthcare Technologies EURO PLAZA, Gebäude E Wienerbergstrasse 41 A-1120 Vienna Phone: (+43) 1 97272 0 Fax: (+43) 1 97272 2222
BELGIUM & LUXENMBURG	GE Medical Systems Ultrasound Eagle Building Koutervеldstraat 20 1831 DIEGEM Phone: (+32) 2 719 7204 Fax: (+32) 2 719 7205
BRAZIL	Equipamentos Médicos Ltda Av. Das Nações Unida, 8501 3º andar parte - Pinheiros São Paulo SP - CEP: 05425-070 C.N.P.J.: 02.022.569/0001-83 Phone: 3067-8493 Fax: (011) 3067-8280
CANADA	GE Healthcare Ultrasound Service Engineering 9900 Innovation Drive Wauwatosa, WI 53226 Phone: (1) 800 668-0732 Customer Answer Center Phone: (1) 262-524-5698
CHINA	GE Healthcare - Asia No. 1, Yongchang North Road Beijing Economic & Technology Development Area Beijing 100176, China Phone: (8610) 5806 8888 Fax: (8610) 6787 1162
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LUXEMBOURG	Phone: 0800 2603 toll free

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United Arab Emirates (U.A.E.)	GE Healthcare Holding Dubai Internet City, Building No. 18 P.O. Box #11549, Dubai U.A.E. Phone: +971 4 4296161 Phone: +971 4 4296101 Fax: +971 4 4296201
UNITED KINGDOM	GE Medical Systems Ultrasound 71 Great North Road Hatfield, Hertfordshire, AL9 5EN Phone: (+44) 1707 263570 Fax: (+44) 1707 260065
USA	GE Healthcare Ultrasound Service Engineering 9900 Innovation Drive Wauwatosa, WI 53226 Phone: (1) 800-437-1171 Fax: (1) 414-721-3865

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Chapter 2

Safety

Describes the safe handling of the Voluson® i and the warning signs

The hand-held (portable) Voluson® i scanner system has been designed for patient and user. Read the following chapters thoroughly before you start working with the machine! The manufacturer guarantees safety and reliability of the system only when all the following cautions and warnings are observed.

INTENDED USE

This system is intended for use by a qualified physician for ultrasound evaluation in the following clinical applications:

Image Acquisition for diagnostic purposes including measurements on acquired image.

Clinical applications:	Patient population:	Operator profile:
• Fetal/Obstetrics • Abdominal/GYN (including infertility monitoring of follicle development) • Pediatric • Small Organ (breast, testes, thyroid, etc.) • Cardiac (fetal cardio) • Peripheral Vascular • Musculo-skeletal Conventional and Superficial • Transvaginal and Transrectal	• Age: all ages (incl. embryos and fetuses) • Location: worldwide • Sex: male and female • Weight: all weight categories	• Qualified and trained physicians or sonographers with at least basic ultrasound knowledge. • The operator must have read and understood the user manual.

CONTRAINDICATIONS

The Voluson® i system is not intended for:

- ophthalmic use or any use causing the acoustic beam to pass through the eye.
- intra-operative use

ESSENTIAL PERFORMANCE OF THE ULTRASOUND SYSTEM

- Acquisition of ultrasound images
- Display of ultrasound images on main display
- Measurement on ultrasound images
- System must remain in a safe condition acc. IEC60601

2.1 Labels and Symbols

2.1.1 Warning labels used in the Basic User Manual

Note *Warning labels in the user manual have to be read and observed before proceeding!*



Notice:

Describes important information that has to be read before proceeding.



Caution:

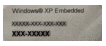
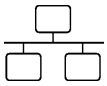
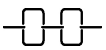
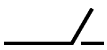
Describes general precautions necessary to protect health and equipment.

	Bio Hazard: Describes precautions necessary to prevent the risk of disease transmission or infections.
	Electric Hazard: Describes precautions necessary to prevent the risk of injury through electric hazards.
	Explosion Hazard: Describes precautions necessary to prevent the risk of injury through explosion hazards!
	Mechanical Hazard: Describes precautions necessary to prevent the risk of injury through mechanical hazards!
	Laser radiation

2.1.2 Description of symbols and labels

Some symbols used with electrical medical equipment have been accepted as standard by IEC. They serve for marking connections, accessories, and as warnings.

	System stand-by switch		Insulated patient application part (Type BF)
IPX7	Protection against the effects of immersion (probes)	PVA1 xxxx/xxxx/xxxx	This label is a marker used during manufacturing and has no meaning relevant to the usage of the device.
	Caution, consult accompanying documents. This symbol advises the user to consult the accompanying documents for important safety-related information such as warnings and pre-cautions that cannot be presented on the device itself.		Consult accompanying documents. This symbol advises the user to consult the accompanying documents.
	This symbol is followed by the name and address of the manufacturer.		This symbol is followed by the manufacturing date in the format YYYY-MM.
	Pictogram on Probe Care Card: Use care when handling ultrasound probes and protect the probe head from damage.		Pictogram on Probe Care Card: Do not immerse the probe into any liquid beyond the level specified for that probe. Refer to the user manual of the ultrasound system.
	Pictogram on Probe Care Card: Describes precautions necessary to prevent the risk of disease transmission or infections.		Pictogram on Probe Care Card: Describes precautions necessary to prevent the risk of injury through electric hazards.
SN	This symbol is followed by the serial number of the device.	LOT	Batch or lot number

REF	Catalog or model number.		Disposal: 'Disposal' *on page 2-15*
	NRTL Classification Label (old and new version)		GOST-R Label
CE 0123	CE Conformity mark according to Medical Device Directive 93/42/EEC 0123: Identification number of the notified body TÜV SÜD Product Service		This product consists of devices that may contain mercury, which must be recycled or disposed of in accordance with local, state, or country laws. (Within this system, the backlight lamps in the monitor display, contain mercury.)
	This symbol indicates PSE rating - required for Japanese market	*Green dot on power cable plug*	Indicates that the power cable is hospital grade. Grounding reliability can only be achieved when the equipment is connected to an equivalent receptacle marked “Hospital only” or “Hospital grade”. Applicable depending on local regulatory requirements.
	This symbol indicates the voltage that the device is built for. This device requires direct current.	90 VA	This indicates the maximum rated power consumption of the system.
	This label represents the license of the operating system used on this device.		Indicates a USB connector.
	Indicates a monitor connector		Indicates a network connector.
	Indicates the battery status LED. 'LED Status Table' *on page 3-6*		Indicates the power status LED. 'LED Status Table' *on page 3-6*
	This symbol indicates the connector for a theft protection lock.		Indicates a docking connector for connecting the system to the Voluson Station.
	Indicates the locking mechanism for the probe connector.		Contains marketing information about VolusonClub. For more information please contact your local sales person.
Q.C OK.	This symbol indicates that the power supply has passed the quality check (optional)		Do not reuse! This symbol indicates that the item/device is for single use only.

	These symbols indicate that at least one of the six hazardous substances of the China RoHS Labelling Standard is above the RoHS limitation. The number inside the circle is referred to as the Environmental Friendly Use Period (EFUP). It indicates the number of years that the product, under normal use, will remain harmless to health of humans or the environment. EFUP = 10 for Short Use Products EFUP = 10 for Short Use Products	Rx only	This symbol indicates that in the United States of America, federal law restricts this device to sale by or on the order of a physician.
	Product was refurbished / remanufactured by GE Healthcare Austria GmbH & Co OG		

2.2 Important Instructions for Safety



FEDERAL LAW RESTRICTS THIS DEVICE TO SALE BY OR ON THE ORDER OF A PHYSICIAN



The use of the system outside the described conditions or intended use, and disregarding safety related information is considered as abnormal use.



Caution! This machine should be used in compliance with the law. Some jurisdictions restrict certain uses such as gender determination.



Caution:

The quality of the image used for diagnosis is essential:

- Changing the display settings can affect the image quality and compromise the diagnostic quality. The user is responsible to use adequate display settings for achieving appropriate image quality. If in doubt, only the image as displayed on the Voluson® ultrasound system with default display settings is to be used for diagnostic purposes.
- Do not diagnose based on print-outs.



The manual refers to probes that can be connected to the device. It might be possible that some probes are NOT available in some countries.

Some features and options are not available in some countries.



Caution:

Features that facilitate measurements (e.g. SonoAVC follicle, Vocal, SonoNT,...) must be used with extreme care. Such measurements are a suggestion of the system. If in doubt verify the measurement results with manual measurement methods. The user is responsible for the diagnostic interpretation of measurements.

Caution:



The system provides calculations (e.g estimated fetal weight) and charts based on published scientific literature. The selection of the appropriate chart and clinical interpretation of calculations and charts are the sole responsibility of the user. The user must consider contraindications for the use of a calculation or chart as described in the scientific literature. The diagnosis, decision for further examinations and medical treatment must be performed by qualified personnel following good clinical practice.



This equipment must not be used in oxygen enriched atmosphere or in the presence of inflammable gases (e.g. anesthetic gases) because of explosion hazard!



The system must only be connected to a fully intact mains socket with a grounded guard wire via an appropriate mains cable. The ground wire must never be removed or disconnected.



Ultrasound systems are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage also when not in use. DO NOT use a damaged or defective ultrasound system. Failure to follow these precautions can result in serious injury and equipment damage.



No covers or panels must be removed from the system (high-voltage risk). Only GE Healthcare authorized personnel must perform service and repairs. Attempting do-it-yourself repairs invalidate warranty are an infringement to regulations and are inadmissible acc. to IEC 60601-1. For expected lifetime of equipment and probes see Service Manual.



There have been reports of severe allergic reactions to medical devices containing latex (natural rubber). Operators are advised to identify latex-sensitive patients and be prepared to treat allergic reactions promptly. Refer to FDA Medical Alert MDA91-1.



Any power supply of additional equipment has to be confirm with IEC60601-1.



Do not touch the patient and the Signal Input/Output lines at the same time.



Disconnect mains from power supply and remove battery pack to make device electroless.



The use of a protective cover is required when performing surgical procedures to prevent contamination and transfer of infectious material to patients and health care workers when operating the system.



This equipment is not to be used during transportation (e.g. ambulance cars, aircrafts).



Use for diagnostic purposes only!

	Misinterpretation of the ultrasound images can lead to a false diagnosis.
	Image quality and penetration depth may be adversely affected when equipment is used on adipose patients.
	Using volume, image or video compression methods at higher rates reduces image quality, which can lead to a false diagnosis.
	Bright light could impact readability of screen.
	Before installing new peripheral devices or other optional items to the Voluson® i, please check the device on cracks or damages. If a device is damaged or has a crack, please contact your local Service or OnlineCenter.
	Do not drop the Voluson® i. This may cause major damage to the device.
	Do not cover the ventilation holes of the Voluson® i.
	Do not use with a defibrillator. This equipment does not have a defibrillator approved applied part.
	Only use with provided power supply. 'Power supply' *on page 20-4*
	CAUTION Laser radiation Avoid exposure to the beam Class 3B laser product CAUTION Class 3B laser radiation When open avoid exposure to the beam

2.3 Electric installation

The system must be exclusively installed in medically used rooms. The equipment conforms with regulations for electrical safety (IEC 60601) and safety class IIa according to the MDD 93/42/EEC regulation for use on human patients. Ultrasound probes are rated Type BF. Local safety regulations may require an additional connection between the potential equilibrium bolt and the building’s grounding system.



Before switching on the first time, the local mains voltage and frequency are to be checked against the values indicated on the Voluson® i rating plate located on the bottom cover. Only authorized personnel must perform any change to the system. Unauthorized modifications may result in hazardous situations.

The minimum required house installation must have 10A.

2.4 Remarks for Safe Use

- Operator profile: Qualified physicians and professional sonographers with at least basic ultrasound knowledge.
- Get acquainted with the transducers and the ultrasound system: read the user manual thoroughly!
- Follow these safety instructions as well as the clinically adopted precautions and measures for hygiene.
- The manufacturer is not liable for damage caused by improper or inexpert use of the device!
- Any ultrasound transducers - irrespective of system and design - are sensitive to shock and shall be treated with care. Pay attention to cracks, which may allow conductive fluids to leak in.
- Authorized personnel shall only perform any type of repair. Never attempt to open a transducer or transducer connector. This leads to a loss of guarantee!
- Do not squeeze, kink, bend or twist probe cables and protect them against mechanical damage.
- The probes must not be exposed to mechanical shock (e.g., by dropping). Any damage caused in this manner invalidates warranty.
- Have the scanner system and the transducers regularly checked (for faulty cables, housing, etc.) by authorized personnel!
- Damage to transducer or cable may lead to a safety hazard, therefore have them repaired immediately!
- Before plugging in or unplugging a transducer, activate the "FREEZE" mode!
- A specialist acquainted with the handling and use of the system shall perform installation and first switch-on and check-up of the system.
- The user must have read and understood the user manual. The system must only be operated by trained and qualified personnel.
- For safety reasons, avoid handling fluids in the vicinity of the system. Fluids leaking into the user interface can damage the Voluson® i.
- Place the unit always on horizontal ground.
- The user manual must always be with the scanner system. It is the user’s duty to ensure this!
- Only probes conforming to type BF requirements may be used with the Voluson® i.
- See the probe’s label. In case of doubt ask authorized service personnel.
- The Voluson® i system has been tested for EMC and is compliant with EN 55011 group 1 class A (CISPR 11 amendment 1) and IEC 60601-1-2.
- Mains power quality should be that of a typical commercial and/or hospital environment. If the user requires continued operation during power mains interruptions, it is recommended that the system be powered from an uninterruptable power source (UPS).

2.5 Environmental Conditions for Operation

For more information see 'Basic Data' *on page 20-2.*

Note *The system is easily portable between rooms.*

Do not operate the system in the vicinity of a source of heat, of strong electric or magnetic fields (close to a transformer), or near instruments generating high-frequency signals, such as HF surgery. These can affect the ultrasound images adversely.

In the event the equipment has been brought from a cold environment (stock room, airfreight) into a warm room, allow several hours for temperature balance and passing of condensation humidity before switching on for the first time.

2.6 Instruction for Use

This equipment has been tested and found to comply with the limits for medical devices in IEC 60601-1-2. These limits are designed to provide reasonable protection against harmful interference in a typical medical installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to other devices in the vicinity. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to other devices, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the device.
- Increase the separation between the equipment.
- Connect the equipment to an outlet on a circuit different from that to which the other device(s) are connected.
- Consult the manufacturer or field service technician for help.

2.7 Biopsy Lines

To achieve best possible accuracy of the display of the needle path, the biopsy lines have to be programmed for each transducer. See ' To program a Single Angle Biopsy Line' *on page 17-22* and 'To program a Multi Angle Biopsy Line' *on page 17-23*.

- The biopsy lines must be programmed once by the service personnel or by the user. The procedure must be repeated if probes and /or biopsy guides are exchanged.
- Before performing a biopsy, make sure that the displayed biopsy line coincides with the needle track (check in a bowl filled with approx. 47ºC warm water).
- The needle used for this alignment verification must not be used for the actual procedure.

  Always use a straight, new and sterile needle for each biopsy procedure.

Depending on the needle stiffness/thickness and the elasticity and composition of the different tissue-types in the path of the biopsy needle, the actual needle track can deviate from the predicted biopsy line. The biopsy needle might bend and not follow a straight line.

2.8 Cleaning and Maintenance

Have the system checked and serviced in regular intervals (once per year) by authorized service personnel. In case of total failure first check if main voltage is present. Mentioning any observations or failure symptoms to the service engineers is helpful.



Before cleaning the scanner switch it off. Do not use disinfection spray nor gas disinfection. Electric parts must be protected from drip water. Keep the touch panel screen clean. Dust and grime on the frame can cause irregular function! Check the main cable, transduser cables, plugs and sockets on a regular basis.



No covers or panels must be removed from the system (high-voltage risk). Only GE Healthcare authorized personnel must perform service and repairs. Attempting do-it-yourself repairs invalidate warranty, and are an infringement to regulations and are inadmissible acc. to IEC 60601-1. For expected lifetime of equipment and probes see Service Manual.



The following table provides cleaning instructions for the ultrasound device. Effective cleaning and disinfection is not possible for parts with narrow gaps and holes (e.g. keyboard, trackball,...). It is the responsibility of the user to decide which cleaning and disinfection procedure is necessary to ensure a safe working environment. Electrical contacts and connectors must not be cleaned. Do not use any other cleaning agents than listed in the table below. Do not spray any liquid directly on the system.

Note *The cleaning instructions apply to Voluson ® i/e, Voluson® Station and Voluson® Dock Cart.*

Component	When	How to clean	Cleaning agent
Probe holder	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	• IPA solution (70% IPA, 30% water) • *Sani-Cloth Active* disinfecting wipes • *Acryl des®*
Probes	daily or after each examination	See Probe Care Card and 'Special Handling Instructions' *on page 18-10*	
User interface	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	• Spiritus dilutus (70% ethanol, 30% water) • *Acryl des®*
Monitor display	daily or after each examination	Wipe gently with absorbent cotton or other soft material like chamois.	Petroleum benzene
Housings	daily or after each examination	Wipe gently with a damp, non-abrasive cloth.	• IPA solution (70% IPA, 30% water) • *Sani-Cloth Active* disinfecting wipes • *Acryl des®*
Peripherals (e.g. printers,...)	Clean according to the instructions of the peripheral manufacturer.		

2.8.1 Safety Test

Scan time limits: According to respective national regulations, and according to the manufacturer recommendations for the medical-technical system.

Range:

a)	Visual inspection:	Housing, connection, operating elements, display facilities, labels, accessories, user manual.
b)	Functional test:	Checking of functions (according to user manual), check also modular combinations and common operability of system and accessories.
c)	Electric test:	Checking of the electric safety of system combinations according to EN 62353 or respective national regulations.

For safety reasons, avoid handling fluids in the vicinity of the system.

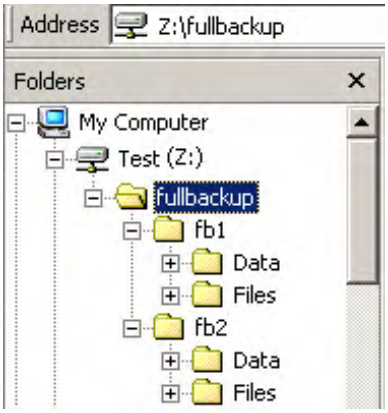
Item	Safety Test	Notes
Console Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.
Peripheral Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.
Surface Probe Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.
Endocavity Probe Leakage Current Checks	Annually	Also after corrective maintenance or as required by your facilities QA program.

2.9 Note for the Administration of “Full Backup” Data

All settings and patient data created since last full backup are **NOT** backed-up! It is highly recommended to create a full backup of settings and patient data regularly.

When the Full Backup is stored on a network drive, it may be desirable to move the data (e.g., for backup or maintenance). For further details review: 'Backup' *on page 16-16*

The directory structure of the full backup data is as follows:



Every “Full Backup” resides in a sub-folder of the main “*fullbackup”*-folder found at the root of the drive. For example: **Z:\fullbackup**.

The sub-folders have the names *fb**X*** where ***X*** is a number (e.g., Z:\fullbackup\fb1). The data resides within a directory structure within these sub-folders. It is possible to move the *fb**X*** sub-folders, even leaving gaps in the numeration sequence. However, **NO** change **MUST** be made to the contents of the *fb**X*** folders itself, otherwise the backup data cannot be restored!

2.10 Manufacturer Responsibility

The manufacturer, assembler, importer or installer considers himself/herself responsible regarding safety, reliability and performance of the instrument under the following conditions:

- when assembling the system, when adding options, when new settings or modifications or repairs were performed by personnel authorized by him/her,
- also that the local electric installation complies to the national regulations, and that the equipment is only used according to the User Manual.

2.11 Service Documents

The Service Manual supplies block diagrams, lists of spare parts, descriptions, adjustment instructions or similar information which help adequately qualified technical personnel in repairing those parts of the instrument which have been defined repairable by the manufacturer. If requested the manufacturer will supply the service manual to authorized technical personnel.

2.11.1 Service Software – Remote Access

By using the remote access feature, a GE field engineer can access the ultrasound system via a modem connection. The field engineers are required to announce every remote connection to a system previously by calling the affected site.

Disruptive Mode:

If the field engineer requires unrestricted access to the ultrasound system the field engineer requests for disruptive mode on the system. A message appears on the screen asking for permission to switch to disruptive mode:

GE Service is requesting permission to diagnose the system remotely. Normal system operations might be disturbed during this period. Click on YES to allow GE Service to continue system diagnostics.

If disruptive mode is accepted, work on the system can be disturbed severely. Therefore, it is not allowed to perform an exam or make a diagnosis using the ultrasound system while being in disruptive mode.

Note *A remote connection can affect the system’s performance (e.g., in 3D/4D or Doppler mode). Therefore, it is recommended to cease work on the system as soon as the field engineer contacts the site and announces the remote connection.*

Network Security:

The remote access features enables, after checkout has been performed, network services like ftp or telnet on the ultrasound system. Therefore, it is advisable to restrict network access to system for unauthorized personnel. It is strongly recommended to use a firewall to restrict

network access from and to an ultrasound system with the remote access feature installed. Other precautions like a secure network segment are encouraged.



For Ethernet connection, a separation device has to be used.

2.12 Bioeffects and Safety of Ultrasound Scans

When ultrasound waves travel through tissue, there is a certain risk for damage. There has been a lot of research on the impact that high frequency waves can have on different kinds of tissues under defined conditions and “There is, to date, no evidence that diagnostic ultrasound has produced any harm to humans – including the developing fetus.” (Guidelines for the safe use of diagnostic ultrasound equipment, Safety Group of the British Medical Ultrasound Society 2010).

Physiological effects due to ultrasound are generally assumed to be deterministic and only occur above a certain threshold in contrast to ionizing radiation, which causes effects accidentally. Thus ultrasound examinations can be held very safe if certain proceedings are followed. It is therefore recommended to read the following sections and study the cited literature.

2.12.1 Prudent Use – ALARA Principle

In spite of the relatively low risk of ultrasound scans compared to other imaging techniques, the operator shall choose the exposure level with caution to minimize the risk of bioeffects.

“A fundamental approach to the safe use of diagnostic ultrasound is to use the lowest output power and the shortest scan time consistent with acquiring the required diagnostic information. This is the **ALARA** principle (i.e. **A**s **L**ow **A**s **R**easonably **A**chievable). It is acknowledged that in some situations it is reasonable to use higher output or longer examination times than in others: for example, the risks of missing a fetal anomaly must be weighed against the risk of harm from potential bioeffects. Consequently, it is essential for operators of ultrasound scanners to be properly trained and fully informed when making decisions of this nature.” (*Guidelines for the safe use of diagnostic ultrasound equipment, Safety Group of the British Medical Ultrasound Society 2010)*

Special care regarding ALARA should be taken with obstetric examinations as any potential bioeffects are likely to be of greatest significance in the embryo or fetus.

It is strongly recommended to consider ALARA when undertaking ultrasound scans.

2.12.2 Bioeffects

- Thermal effects refer to heating of soft tissue and bone

  The thermal indices TIs (soft tissue), TIb (bone near focus) and TIc (bone near surface) were introduced to provide the operator a relative potential for a tissue temperature rise. According to the Standard for Real-time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment (2004) those thermal indices shall be displayed by this ultrasound console. It should be noted that a TI of 1 does not necessarily mean that tissues being scanned will increase in temperature by 1˚C – almost every scanning situation departs from the assumed model conditions, such as tissue type, blood perfusion, mode of operation and actual exposure time of the scanned area. However, the thermal indices provide information regarding the possible increase in the risk of potential thermal bioeffects and it provides a relative magnitude that can be

used to implement ALARA. In addition to tissue heating due to the generated ultrasound field, the temperature of the probe head itself can also increase during the examination. The operator shall be aware, that in the tissue region near the ultrasonic transducer, there will be a superposition with the heating due to the ultrasound field, which is not considered by the TI values.

- Nonthermal effects refer to mechanical phenomena such as cavitation

  Nonthermal bioeffects are caused by the interaction of ultrasound fields with very small pockets of gas (stabilized gas bodies), i.e. the generation, growth, vibration and possible collapse of microbubbles within the tissue. This behavior is referred to as cavitation (Medical Ultrasound Safety, 2nd Edition, AIUM 2009/American Institute of Ultrasound in Medicine Consensus Report on Potential Bioeffects of Diagnostic Ultrasound, AIUM 2008/Guidelines for the safe use of diagnostic ultrasound equipment, Safety Group of the British Medical Ultrasound Society 2010). The potential of cavitation increases with the rarefactional peak pressure but decreases with the pulse frequency. Therefore the Mechanical Index MI was introduced to take account of both the pressure and the frequency. The higher the MI the greater is the risk of nonthermal bioeffects.

2.12.3 Regulated Parameters

Relevant parameters having physiological effects (*For more information see* 'Bioeffects' *on page 2-13.*) are regulated according to FDA and IEC guidelines and standards. These parameters are

Parameter	Meaning	Limit	Displayed
MI	Mechanical Index	1.9	Yes
TIs, TIb, TIc	Thermal Indices TI – one of the following values can be displayed: TIs: soft tissues TIb: bone in focal region TIc: bone at surface (e.g. cranial)	6	Yes
Ispta.3	Averaged intensity at spatial peak with a derating of 0.3dB/(cm MHz)	720 mW/cm2	No
T	Temperature at the patient's side of the probe – lower limit during patient contact, higher limit for rest position	43˚C/50˚C (109.4˚F/122˚F)	No

2.12.4 Interpretation of displayed parameters MI and TI

During obstetric examinations these displayed values shall be observed very critically, because there may be conditions that are potentially hazardous even below the regulatory limits.

Some guidelines recommend that embryonic and fetal in situ temperatures of 41˚C (4˚C above normal temperature) should be limited in time by 5 min or less. Thus, for a reasonable safety margin, TI values above 1 should be avoided. Additional factors, like fever of the mother, are again reasons to keep the TI values as low as possible on the one hand, and go only as high as necessary to achieve the desired clinical results ('Prudent Use – ALARA Principle' *on page 2-13*).

The mechanical index, which indicates the risk of cavitation, becomes important at the interface between gas and soft tissue (nonfetal lung and bowel), but also with the use of gas body contrast agents. Often an MI value of 0.4 or less is suggested for examinations of tissue

containing stabilized gas bodies. This value arises from operating experience and is not confirmed.

Some examples where the MI and TI, respectively, are more or less important are shown in the following table according to *Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment, IEC 60601-2-37 2nd Edition, 2007, Annex CC.*

	Of greater importance	Of less importance
MI – Mechanical Index	With contrast agents Cardiac scanning (lung exposure) Abdominal scanning (bowel gas)	In the absence of gas bodies, i.e. most tissue scanning
TI – Thermal Indices	1st trimester scanning Fetal skull and spine Neonatal head Patient with fever Poorly perfused tissue Scanning near ribs or bone: TIb	Well perfused tissue, i.e. liver, spleen Cardiac scanning Vascular scanning

Further information can be retrieved from *Bioeffects & Safety of Diagnostic Ultrasound, AIUM, 1993 and Evaluation of Research Reports: Ultrasound Bioeffects Literature Reviews (1992-2003).*

2.12.5 Reporting Tables

Acoustic output reporting tables according to the below cited standards are provided in the *Basic Service Manual*.

Particular requirements for the basic safety and essential performance of ultrasonic medical diagnostic and monitoring equipment, IEC 60601-2-37 2nd Edition, 2007.

Information for Manufacturers Seeking Marketing Clearance of Diagnostic Ultrasound Systems and transducers, FDA Guidance, 2008.

Ultrasonics - Field characterization - Test methods for the determination of thermal and mechanical indices related to medical diagnostic ultrasonic fields, IEC 62359 1st Edition, 2005.

2.13 Disposal



This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact the manufacturer or an other authorized disposal company to decommission your equipment according to local regulations.

2.13.1 Battery disposal



Lithium battery included with this device. Do not puncture, mutilate or dispose of battery in fire. Replace only with same type recommended by the manufacturer. Dispose of used battery according to manufacturers instructions and in accordance with your local regulations.

2.14 Guidance and manufacturer´s declaration

Guidance and manufacturer´s declaration - electromagnetic emissions		
The Voluson® i is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson® i should assure that it is used in such an environment.		
Emission test	Compliance	Electromagnetic environment - guidance
RF emissions - CISPR 11	Group 1	The Voluson® i uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions - CISPR 11	Class A	The Voluson® i is suitable for use in all establishments (i.e. hospitals, doctors practice etc.) other than domestic. The Voluson® i is intended for professional use only.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

Guidance and manufacturer´s declaration - electromagnetic immunity			
The Voluson® i is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson® i should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment- guidance
Electrostatic discharge (ESD) IEC 61000-4-2	± 2,4,6 kV contact ± 2,4,8 kV air	± 2,4,6 kV contact ± 2,4,8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/ burst IEC 61000-4-4	± 2kV for power supply lines ±1kV for input/output lines	± 2kV for power supply lines ±1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	± 1kV differential mode ± 2kV common mode	± 1kV differential mode ± 2kV common mode	Mains power quality should be that of a typical commercial or hospital environment.

Guidance and manufacturer´s declaration - electromagnetic immunity			
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	< 5% UT (> 95% dip in UT) for 0.5 cycle	< 5% UT (> 95% dip in UT) for 0.5 cycle	Mains power quality should be that of a typical commercial or hospital environment.
	40% UT (60% dip in UT) for 5 cycles	40% UT (60% dip in UT) for 5 cycles	
	70% UT (30% dip in UT) for 25 cycles	70% UT (30% dip in UT) for 25 cycles	
	< 5% UT (>95% dip in UT) for 5 s	< 5% UT (>95% dip in UT) for 5 s	
Power frequency magnetic field (50/60Hz) IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a commercial and hospital environment.
NOTE: UT is the a.c. mains voltage prior to application of the test level			

Guidance and manufacturer´s declaration - electromagnetic immunity			
TheVoluson® i is intended for use in electromagnetic environment specified below. The customer or the user of the Voluson® i should assure that it is used in such an environment.			
Portable and mobile RF communications equipment should be used no closer to any part of the Voluson® i, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment- guidance
Conducted RF IEC 61000-4-6	3Vrms / 150kHz to 80 Mhz	3Vrms	Recommended separation distance $d = [\frac{3,5}{V_1}]\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m; 80MHz to 2.5 GHz	3 V/m	$d = [\frac{3,5}{E_1}]\sqrt{P}$ 80MHz to 800 MHz $d = [\frac{7}{E_1}]\sqrt{P}$ 800MHz to 2.5GHz

Guidance and manufacturer´s declaration - electromagnetic immunity
where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strength from fixed RF transmitters, as determined by an electromagnetic site survey, (a) should be less than the compliance level in each frequency range.(b) Interference may occur in the vicinity of equipment marked with following symbol: 
NOTE: a) Field strength from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast cannot be predicted theoretically with accuracy. To access the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Voluson® i is used exceeds the applicable RF compliance level above, the Voluson® i should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Voluson® i. b) Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m. In the working frequency range of the ultrasound system from 1 to 30 MHz an influence on the ultrasound image can be visible in the presence of electromagnetic radiation at 200 to 500mV/m depending on the probe connected.

Recommended separation distances between portable and mobile RF communications equipment and the Voluson® i			
The Voluson® i is intended for use in an electromagnetic environment in which radiated RF disturbance are controlled. The costumer or the user of the Voluson® i can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 Mhz	80 MHz to 800 Mhz	800 MHz to 2,5 GHz
	$d = 1,17 \times \sqrt{P}$	$d = 1,17 \times \sqrt{P}$	$d = ((2,33)) \times \sqrt{P}$
0.01	0.12	0.12	0.233
0.1	0.37	0.37	0.74
1	1.17	1.17	2.33
10	3.7	3.7	7.4
1	11.7	11.7	23.3
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in meters (m) can be estimated using equation applicable to the frequency of transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
Note 1 At 80MHz and 800MHz, the separation distance for the higher frequency range applies.			
Note 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

2.15 Network disclosure

Purpose and scope

This disclosure is intended to satisfy the requirements of IEC 60601-1:2005 clause 14.13 and IEC/ISO 80001-1:2010 clause 3.5 for disclosure of network-related specifications, requirements and residual risks in order to facilitate the responsible organization's risk management activities (e.g. pursuant to 80001-1) for their networks incorporating the Voluson® i.

Purpose of the network connection

The connection options (USB, Ethernet, WLAN, Bluetooth) provide a possibility for data transfers from and to the Voluson® i. This allows the customer to use a convenient database system for data management and data sharing e.g. within a hospital or any other relevant organizations. Also simple standard device connections, such as printers, USB storage devices or similar, are provided by the USB connection for data exchange.

Network interface technical specifications

Physical and link layer interface:	Ethernet IEEE 802.3 10BASE-T, 100BASE-TX
Internet Protocol Version:	IPv4
IP-Addressing:	static or DHCP

Physical and link layer interface:	WLAN IEEE 802.11b/g
Internet Protocol Version:	IPv4
IP-Addressing:	static or DHCP

Enabled Host-to-Host communication protocols:

- DNS – Only used as client.
- DHCP – Only used as client.
- NetBIOS – Name, Datagram, Session services, Network file share MS network. Only used as client.
- Insite ExC – Device servicing by GE Remote Service.
- ACR/NEMA Digital Imaging and Communications in Medicine (DICOM)
  - DICOM Conformance Statement: http://www.gehealthcare.com/usen/interoperability/dicom/products/ultrasound_dicom.html
  - IHE Integration Statement: http://www.gehealthcare.com/usen/interoperability/ihe.html

Required IT network characteristics

Recommended throughput 100 Mbit/sec

Ports open to Internet: 3003 - Insite ExC

Ports open only to secure LAN closed to Internet:

- 53 – DNS Client
- 68 – DHCP Client

- 104 – DICOM
- 137,138,139, 445 – Netbios/Fileshare

Potential hazardous situations resulting from failures of the IT network

The following general hazardous situations have been identified as potentially arising as a result of the IT network failing to provide the required characteristics specified above:

- Delayed or impaired access to images or other exam information or patient data.
- Permanent loss of images or other exam information or patient data.
- Corruption of images or other exam information or patient data.

Chapter 3

Getting Started

Describes the usage of the Voluson® i, the mechanical design, the general software usage and the Electronic User Manual.

3.1 Product Description

The Voluson® i is a professional, innovative, most versatile real-time scanning system. It opens new sonographic possibilities with the 3D/4D VOLUME scanning technique. The vast array of probes makes it suitable for many applications.

The system offers the following diagnostic possibilities:

- 2D Mode
- M Mode, MCFM (M+Color Flow Mode)
- Spectral Doppler (Pulsed Wave)
- Color-Doppler (Velocity-, Power imaging)
- Volume Mode (3D sectional image analysis interactive 3D rendering and Real Time 4D)

Note *The application fields are dependent of the selected probe.*

The system is designed for follow-up expansion.

Operable probes:

- Multi-element probes (linear array and curved array)
- Real Time 4D Volume probes

The operation is designed for the specific clinical requirements and ensures simple and efficient handling. Vast ranges of measuring and evaluation programs, as well as many special functions enable comfortable working. The interface with interface software provides quick digital archiving of images and/or volume data sets on mass storage medium. A network interface (Ethernet) provides documentation in DICOM standard.

3.2 Preparing the unit for use

The Voluson® i ultrasound unit must operate within the proper environment and in accordance with the requirements described in this section. Before using the system, ensure that the requirements are met.

3.2.1 Power requirements

The Voluson® i ultrasound unit is powered either by its internal battery or by a separate power supply adaptor unit connected to a separate power outlet for any range of:

Power supply adaptor:

AC Input: 100 – 250 VAC, 3-1.5 A, 47– 63 Hz.

DC Output: 20 VDC, 6A

3.2.2 Electromagnetic interferences

Ensure that the unit is protected from electromagnetic interferences as follows:

- Operate the unit at least 4.5 meters (fifteen feet) away from and other environ-equipment that emits strong electromagnetic radiation.
- Shield the unit when operating it in the vicinity of radio facilities, in terms of broadcasting equipment, if necessary

3.2.3 Connecting the unit

GE-qualified person should perform the initial system installation. Connecting the Voluson® i ultrasound unit involves preliminary checks of the power adaptor unit and cord, voltage level and compliance with electrical safety requirements. Use only power supply cords, cables and plugs provided by or designated by GE Healthcare Austria GmbH & Co OG. Ensure that the power cord and plug are intact and that the power plug is the proper hospital-grade type (where required). When using the mains outlets, the unit should be connected to a fixed power socket which has the protective grounding connector. Never use an extension cord or adaptor plug.



Failure to provide an adequate earth circuit can cause electrical shock, resulting in serious injury.

Check the label on the Voluson® i's AC power adaptor.Check the voltage range indicated on the label:

- 100–240 V, 1.08–0.45 A, 50/60 Hz



If the mains supply is not within the specified range, do not connect the unit to the power source. Contact the dealer to have the unit adjusted to the specific mains supply.

3.2.4 Connecting to the electrical outlet

The unit's power must be supplied from a separate, properly rated outlet to avoid risk of fire. Refer to "Power requirements" on page 9 for rating information. The power cord should not, under any circumstances, be altered to a configuration rated less than that specified for the current. Do not use an extension cord or adapter plug.

1. Connect the AC power adaptor output plug into the appropriate socket on the rear of the Voluson® i.
2. Ensure that the wall outlet is of appropriate type.
3. Secure the power plug in the wall outlet.

AC Power Cord requirements

- Type SJT, SJE, SJO or SJTO, 18 AWG, 3-Conductor, VW-1 or FT-2 or equivalent, 250 V, 10 A, max 2.5 m long;
- One end with Hospital Grade Type, NEMA 5-15P or 6-15P etc. if required by relevant national standards.
- Other end with appliance coupler C13.

3.2.5 AC Adaptor



Use only the special AC Power adaptor for Voluson® i , specifically designed and approved by GE. Be sure that nothing rests on the AC adaptor's power cable and that the cable is not located where it can be tripped over or stepped on. Place the AC power adaptor in a ventilated area, such as a desk, when you use it to run the Voluson® i. Do not cover the AC power adaptor with paper or other items that will reduce cooling; do not use the AC power adaptor inside a carrying case.

3.2.6 Battery

The lithium ion battery provides power when an AC power source is not available. A battery in the battery bay is standard with the Voluson® i. You can expect one hour of battery life with a single fully charged battery. Lithium ion batteries last longer than conventional batteries and do not require replacement as often. The lithium ion technology used in the system's battery is significantly less hazardous to the environment than the lithium metal technology used in some other batteries (such a watch batteries). Used batteries should not be placed with common household waste products. Contact local authorities for the location of a chemical waste collection program nearest you.

Note *The battery is designed to work with Voluson® i systems only. Only use the batteries authorized by GE.*



The battery has a safety device. Do not disassemble or alter it. Operate (charge/discharge) the batteries only in specified environment conditions, see 'Environmental Conditions for Operation' *on page 2-9*. Do not short-circuit the battery by directly connecting the battery terminals with metal objects. Do not heat the battery or discard it in a fire. Do not expose the battery to temperature other than specified, see 'Data' *on page 20-5*. Keep it away from fire and other heat sources. Do not leave the battery in direct sunlight. Do not pierce the battery with a sharp object, hit it, or step on it. Do not use a damaged battery. Do not solder a battery. Do not connect the battery to an electrical outlet.



Use the seperate battery charger only outside the patient environment.



If the Voluson® i is not being used on a monthly basis, the battery needs to be removed during lengthy non-use period.



To avoid the battery bursting, igniting, or fumes from the battery causing equipment damage, observe the following precautions:

- Do not immerse the battery in water or allow it to get wet.
- Do not put the battery into a microwave oven or pressurized container. If the battery leaks or emits an odor, remove it from all possible flammable sources.
- If the battery emits an odor or heat, is deformed or discolored, or in a way appears abnormal during use, recharging or storage, immediately remove it and stop using it.
- If you have any questions about the battery, consult GE or your local representative.
- Storage of battery pack:
- Short term (less than one month): 0˚ C (32˚F) - 50˚ C (122˚F)
- Long term (more than three months): 10˚ C (50˚ F) - 35˚ C (95˚F).
- Use only GE recognized batteries.



Warning

Do not send (by any means) defective or damaged batteries. There might be a potential of producing a dangerous evolution of heat, fire or short circuit etc. during transport. Special national and/or international regulations apply to shipping batteries, especially when transported by air freight.

3.2.7 Screen symbols and Battery status

When the system is running, the status icons are displayed in the system Status bar to indicate the operations and the current battery status.

Icon	Status Description
	AC Power is on ; no battery present
	AC Power is on; battery is full
	Battery in use; battery almost empty
	Battery in use; fully charged
	Battery in use; partly charged
	AC Power is on; battery is charging
	Networkcable: connected
	Networkcable: disconnected
	Networkcable: connected, remote service activities detected
	Printers: Button to click to access the print configuration dialog.

3.2.7.1 Tooltips

To get more information of the Screen symbols move the mouse pointer on the prefered symbol and wait a few seconds, the Tooltip will pop-up and show you the informations.

3.3 Mechanical Design



1. Display latches	2. LCD Display
3. Handle	4. On/Off button
5. Probe locking lever	6. Probe connector
7. Active Mode Wheel and TGC controls	8. Trackball and trackball buttons
9. Functional keyboard	10. Alpha-numeric keyboard
11. Menu soft buttons	12. Power indicator

3.3.1 LED Status Table

Power Supply	**Connected**							
Power / Battery LED								
Battery Level	**0-5%**		**6-39%**		**40-75%**		**76-100%**	
Battery Level	0-5%		6-39%		40-75%		76-100%	
Standby Mode	-	-	*Y*	*G*	*G*	*G*	*G*	*G*
Power ON	**G**	-	**G**	**Y**	**G**	**Y**	**G**	**G**
Power OFF	**G**	-	**G**	-	**G**	-	**G**	-

Power Supply	**Not Connected**							
Power / Battery LED								
Battery Level	**0-5%**		**6-39%**		**40-75%**		**76-100%**	
Battery Level	0-5%		6-39%		40-75%		76-100%	
Standby Mode	-	-	-	*Y*	-	*G*	-	*G*

Power Supply	Not Connected							
Power / Battery LED								
Battery Level	0-5%		6-39%		40-75%		76-100%	
Power ON	-	-	-	*Y*	-	**Y**	-	**G**
Power OFF	-	-	-	*Y*	-	-	-	-

- ... LED is off

Y ... Yellow blinking LED

G ... Green blinking LED

Y ... Yellow LED

G ... Green LED

3.4 System Assembly

3.4.1 Basic System

It consists of the following modules:

1. Probe connector module:

This module houses the entire electronics with for connections, up to 1 probe connector and the beamformer module (transmit and receive electronics).

2. Control console:

The control console consists of the hard keys,Menu control and the trackball, the loudspeakers, and the probe holder.

3. Color monitor

4. Doppler module:

Spectral Doppler module enables the evaluation of blood flow ratios with pulsed and continuous wave and is built into the main electronic module.

Color-Doppler module enables color-coded evaluation of blood flow conditions and is built into the main electronic module.

3.4.2 Optional Peripheral Devices

Available peripherals for the Voluson® i include:

- DVD recorder (USB)
- Black / White Printer (USB)
- Digital Color Printer (USB)
- Line Printer / Bluetooth Printer

For detailled information review the Voluson® i's product catalog.

The leakage current of the entire system including any/all auxiliary equipment must not exceed the limit values as per EN 60601-1 (IEC 60601-1) resp. other valid national or international standards.

Connection of auxiliary equipment: 'Internal and External connections' *on page 19-8*.

3.4.3 Wireless LAN

Use the optionally available wireless LAN USB stick to connect to wireless networks and devices.

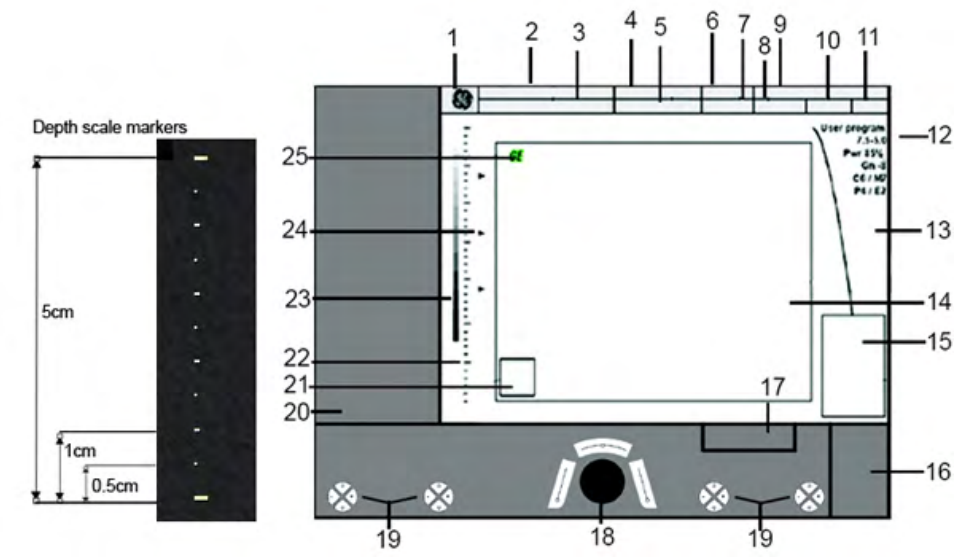
For connection see: 'Hardware options' *on page 19-4*

For adjusting a wireless LAN connection see: 'Wireless LAN configuration' *on page 16-34*

3.4.4 Optional Modules

Optional modules according to the pricelist of Voluson® i.

3.4.5 Position of Display Annotation



1)	Logo	14)	Image Area
2)	Patient Name (last-, First-, Middle Name)	15)	Measurement results
3)	Patient ID-number ; GA (Gestational Age)	16)	Systemstatus (network, battery, printer)
4)	Probe / Application	17)	Status of Freeze key
5)	Depth / Frame rate	18)	Status of Trackball
6)	Mechanical Index	19)	Status of Menu control buttons
7)	Thermal Index	20)	Softkey area
8)	Sonographers Name	21)	Bodymarks
9)	Hospital Name	22)	Depth scale markers

10)	Date	23)	Gray scale wedge
11)	Time	24)	Focal zone marker(s)
12)	Image Info	25)	Orientation marker
13)	TGC curve		

3.5 Concept of Operation

The control center is the console with the hard keys, the Menu control, the keyboard (with shortcut functions) and the trackball. The console controls frequently used functions, e.g., Freeze/Run, change of modes, etc. Additional functions are controlled via the trackball.

MENU CONTROL and TRACKBALL

Activated functions are easily controlled by these controls. By rotating resp. switching they deliver digital pulses and can be selected by program call-up. They are displayed in the status area by their location, their function, and their actual value of setting.

KEYBOARD-SHORTCUT FUNCTIONS

The available menus are shown in the menu area on the left side of the screen. The current menu selection is highlighted.

Roll with the trackball and the arrow moves to another selection.

The corresponding keyboard shortcuts are shown to the left of the actual function.



For Example:

In static 3D Mode, press the shortcut key **[U]** on the keyboard, to set the rendering mode.

Note *Pressing the left or right trackball key [Set] starts selected menu function.*

3.5.1 Changing of Menus



Each menu has its own [Sub Menu]. By selecting this menu item the related menu appears in the menu area on the left side of the screen.



Utilities

To display the “Utilities” menu.

Remark: If no probe is selected, the Utility key is inactive.

3.5.2 Layout of the 2D Mode Main Menu

Example:



Remarks:

Selecting a new mode displays a new “Main” menu with the operating functions of this mode. The functions Focus, OTI, Beta View, Frequency, Angle, Trapezoid mode and FFC only appear in the menu- and status area if they are available for the selected probe.

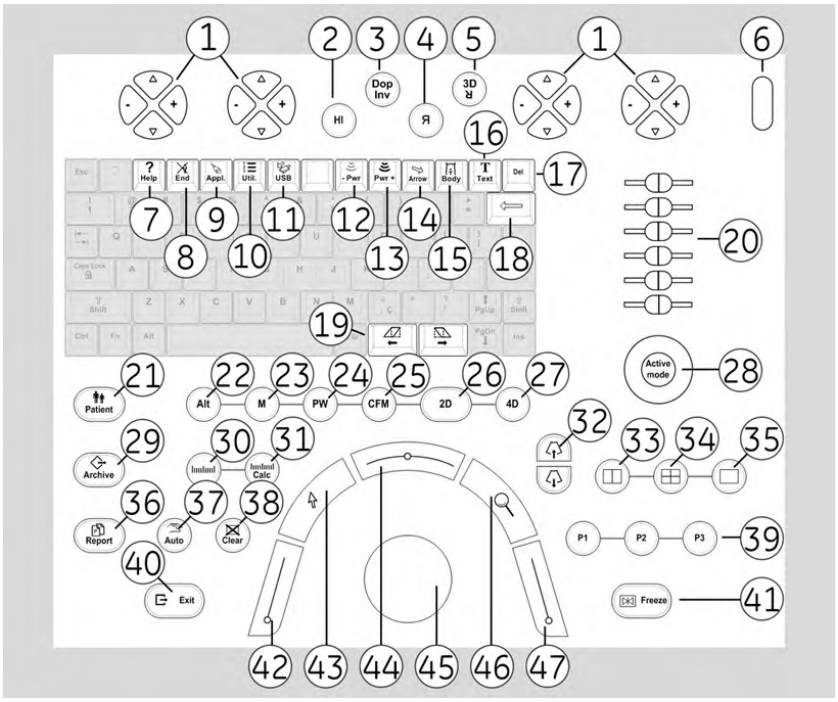
Image Info:	**B (2D) Mode**
User program	Name of user program
7.5-5.0	Receiver frequency [MHz]
Pwr 85 %	Acoustic power [%] or fixed to maximum power 100
Gn -12	Gain [dB]
C5 / M7	Dynamic curve [number] and Gray map [number]
P6 / E4	Persistence [number] and Edge enhancement [number]
Image Info:	**M Mode**
Gn 10	Gain [dB]
EE 1	Edge enhancement [number]
Rej 10	Reject [number]
Image Info	**D (PW) Mode**
Pwr 85 %	Acoustic power [%] or fixed to maximum power

Gn 10	Gain [dB]
WMF 230 Hz	Wall motion filter [Hz]
SV Angle 60º	Angle correction
Size 2.0 mm	Sample volume size
Frq mid	Transmit frequency [Probe data]
PRF 1.2 kHz	Velocity Range [kHz, cm/s, m/s]
Image Info:	**CFM-Mode, PD-Mode**
Pwr 85 %	Acoustic power [%] or fixed to maximum power 100
Gn 60	Gain [dB]
Frq mid	Transmit frequency [Probe data]
Qual mid	Quality of CFM [table]
WMF mid	Wall motion filter [table]
PRF 1.2 kHz	Velocity Range [kHz, cm/s, m/s]
Image Info:	**3D/4D Mode**
User program	Name of 3D/4D user program
Th26 / Qual high1	Threshold [number] and Quality [table]
B68º / V55º	Angle of the Volume Box [degree] and Volume Angle [degree
Mix 16/84*	Mix between selected render modes [percent]
SRI II	Displays if SRI is activated
Mode	selected Acquisition Mode

Remarks:

- When the Automatic Optimization function is active, an asterisk (***** next to the Gray map number) is displayed in the B mode Image Info area.
- The Image Info in 3D/4D Mode depends on the selected Acquisition and Visualization Mode.

3.5.3 Control Panel



UI controls			
1) Menu-Softbuttons	2) Harmonic Imaging (HI)	3) Doppler Invert	4) Left/Right Image Orientation
5) 3D-Up/Down Image Orientaion	6) Power button	7) Help button	8) End Exam
9) Probe Application	10) Utilities	11) Unplug USB	12) Power reduce
13) Power increase	14) Arrow	15) Body	16) Text
17) Delete	18) Text	19) Beam steering	20) TGC Slider Controls
21) Patient Data Entry	22) Alt	23) Motion Mode	24) Pulsed Wave Doppler
25) Color Flow Mode	26) 2D Mode	27) Real Time 4D Mode	28) Active Mode
29) SonoView	30) Caliper	31) Calculations	32) Depth
33) Dual-Screen Format	34) Quad-Screen Format	35) Single-Screen Format	36) Report (Worksheet)
37) Auto Mode	38) Clear All	39) P1 P2 P3 keys	40) Exit
41) Freeze/Run	42) Left trackball key	43) Point	44) Upper trackball key
45) Zoom	46) Right trackball key	47) Trackball	

3.5.4 Hard Keys



Power button
Press this button to turn on or to shut down the system.



Read/Write (Freeze/Run)
Button is green: image is frozen (read mode). Button is white: real time scan (write mode). *For more information see* ' To Freeze an Image' *on page 4-6.*



P1
Programmable key P1
Can be programmed for printing, saving or exporting data. *For more information see Chapter 15.*



P2
Programmable key P2
Can be programmed for printing, saving or exporting data. *For more information see Chapter 15.*



P3
Programmable key P3
Can be programmed for printing, saving or exporting data. *For more information see Chapter 15.*



Calculations
allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items for different applications. *For more information see Chapter 13.*



Caliper
For more information see Chapter 12.



Clear All
to clear graphics, measurements and annotations on the screen



Arrow
display a pointer arrow. *For more information see* 'Indicator' *on page 4-25.*



Body
add body mark symbols to the image. *For more information see* 'Bodymarks' *on page 4-26.*



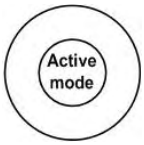
Text

add text to the image. *For more information see* 'Image Annotation ' *on page 4-22.*



Auto Mode

In 2D Mode: Pressing this key causes automatic optimization of the gray scale to enhance the contrast resolution. *For more information see* '2D Automatic Optimization' *on page 5-5.* In PW Mode: Press this key for automatic optimization of the PRF and Baseline. *For more information see* ' PW Automatic Optimization' *on page 7-5.* In 3D/4D Mode: Pressing this key causes automatic optimization of the sectional planes A, B and C. The rendered image is not affected. *For more information see* 'Sectional Planes' *on page 10-41.*



Active Mode

If mode combinations are used, the Active mode switches between mode -gain controls



Application

Open the Probe Application Program menu for changing the probe application. *For more information see* ' Probe/Program Selection' *on page 4-4.*



Patient Data Entry

display the patient data entry menu (the previous exam will be closed). *For more information see* 'Entering Patient Data' *on page 4-6*.

The key can also be programmed to act as a “New” key: *For more information see* 'To program the Patient hardkey' *on page 15-3.*



End Exam

Patient and measurement data are stored in the “Data manager” and all temporary patient and measurement data are cleared. *For more information see* ' End Exam' *on page 4-7.*

Caution: It is absolutely necessary to press this key before switching OFF the system. Otherwise the current Patient data as well as all the measurements in the Patient report will be lost.



Utilities

to display the Utilities menu. *For more information see Chapter 11.*



Doppler Invert

pressing this button causes invert of the Doppler spectrum, the M mode display as well as Color invert in Color Doppler mode



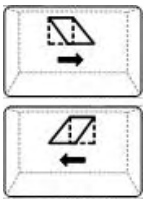
3D-Up/Down Image Orientation

press this key to change the image orientation of the 3D-image or alternate between up and down orientation in 2D mode.



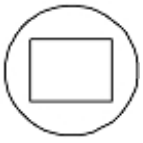
Left/Right Image Orientation

to alternate between left and right image orientation



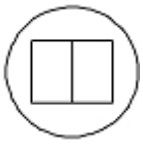
Beam steering keys

pressing evokes beam steering (left or right), provided the active probe allows for it



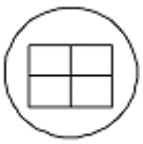
Single-Screen Format

select the display format (Single screen display) in 2D and 3D image mode



Dual-Screen Format (vertical distribution)

select the display format (Dual screen display) in 2D and 3D image mode. *For more information see* 'Multi Format' *on page 5-9.*



Quad-Screen Format

select the display format (Quad screen display) in 2D and 3D image mode. *For more information see* 'Multi Format' *on page 5-9.*



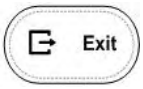
SonoView

press this key to access images on the hard drive. *For more information see Chapter 14.*



Report (Worksheet)

press this key to review the Patient worksheet of the currently selected application. *For more information see Chapter 13.*



Exit

to exit the current menu



Power reduce

lower the acoustic output of the system. *For more information see* 'Transmit Power' *on page 5-5.*



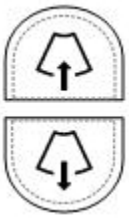
Power increase

increase the acoustic output of the system. *For more information see* 'Transmit Power' *on page 5-5.*



Unplug USB

For more information see 'Delete Full Backup' *on page 16-23.*



Depth

select the display depth of the 2D image (up and down). '2D Mode Depth' *on page 5-3*



Coded Harmonic Imaging

on/off key for Coded Harmonic Imaging. *For more information see* 'Harmonic Imaging (HI)' *on page 5-7.*



Real Time 4D Mode

activates the Real Time 4D mode (continuous volume sweep) or static 3D mode. *For more information see Chapter 10.*



Color Flow Mode

on/off key for Color Flow Mode. *For more information see Chapter 8.*



2D Mode (all additional modes will be switched off)

Pressing this control activates the 2D mode. *For more information see Chapter 5.*



Alt

no function



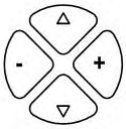
Pulsed Wave Doppler (on/off)

Pressing starts the PW Doppler mode provided the active probe allows function. *For more information see* 'PW Mode (Pulsed Wave Doppler) ' *on page 7-2.*



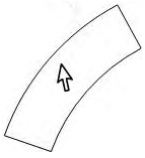
Motion Mode (on/off)

Pressing starts the M mode provided the active probe allows function. *For more information see Chapter 6.*



Menu-Softbuttons: Menu Controls

4 Switches: up, down, plus, minus.



Point:

Brings up a cursor for menu and image operations.



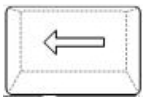
Zoom:

Activates/Deactivates Zoom mode



Delete

Deletes the actual annotations or markers on the screen



Backspace

Deletes the last created annotations or markers on the screen, depends on the activated arrow or text



Help button

Press the **[?]** button to invoke the electronic user manual. *For more information see* 'Electronic User Manual (EUM)' *on page 3-17.*

3.5.4.1 Function of the Trackball at Diverse Dialog Pages

In general operations at diverse dialog pages and windows on the system desktop (e.g., Patient Data Entry, Usage of EUM, System Setup, Measurement Setup, etc.) are done with the trackball and the trackball keys (mouse emulation).



Trackball (mouse position):
positions the pointing device (arrow) on the desktop



left trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device



upper trackball key (right mouse button): no function in system desktop



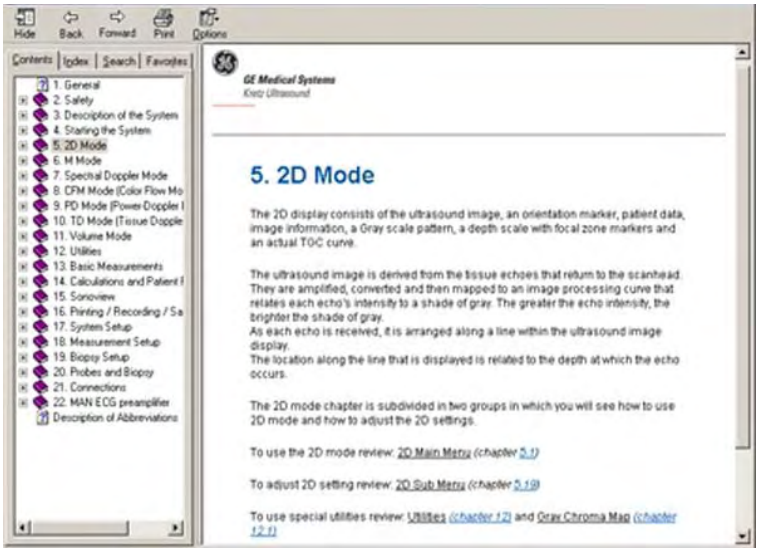
right trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device

3.6 Electronic User Manual (EUM)



Press the **[Help]** key on the keyboard to invoke the electronic user manual.

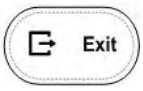
The EUM screen appears (e.g.: 2D Mode)


Hide
Back
Forward
Print
Options
Contents
Index
Search
Favorites
1. General
2. Safety
3. Description of the System
4. Starting the System
5. 2D Mode
6. M Mode
7. Spectral Doppler Mode
8. CFM Mode (Color Flow Mo
9. PD Mode (Power Doppler I
10. TD Mode (Tissue Dopple
11. Volume Mode
12. Utilities
13. Basic Measurements
14. Calculations and Patient I
15. Sonoview
16. Printing / Recording / Sa
17. System Setup
18. Measurement Setup
19. Biopsy Setup
20. Probes and Biopsy
21. Connections
22. MAN ECG preamplifier
Description of Abbreviations
GE Medical Systems
5. 2D Mode
The 2D display consists of the ultrasound image, an orientation marker, patient data, image information, a Gray scale pattern, a depth scale with focal zone markers and an actual TGC curve.
The ultrasound image is derived from the tissue echoes that return to the scanhead. They are amplified, converted and then mapped to an image processing curve that relates each echo's intensity to a shade of gray. The greater the echo intensity, the brighter the shade of gray.
As each echo is received, it is arranged along a line within the ultrasound image display.
The location along the line that is displayed is related to the depth at which the echo occurs.
The 2D mode chapter is subdivided in two groups in which you will see how to use 2D mode and how to adjust the 2D settings.
To use the 2D mode review: 2D Main Menu (chapter 5.1)
To adjust 2D setting review: 2D Sub Menu (chapter 5.19)
To use special utilities review: Utilities (chapter 12) and Gray Chroma Map (chapter 12.1)

The Help screen is divided into three sections:

1. **Navigation Tools** - on the upper left. *For more information see* 'Navigation Tools' *on page 3-18.*
2. **Navigation Tabs** - below Navigation tools. *For more information see* ' Navigation Tabs' *on page 3-19.*
3. **Content pane** on the right side of the screen where help topics are displayed

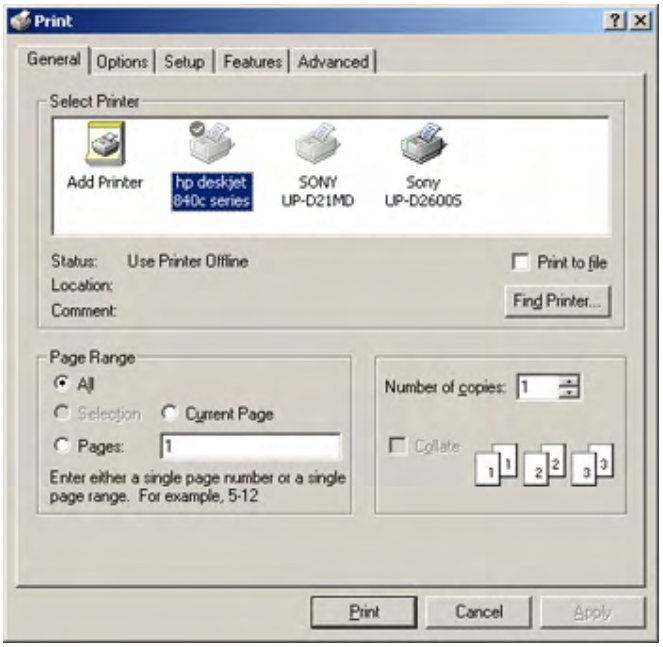
3.6.1 To Exit the Electronic User Manual



Press the **[Exit]** key on the control panel to exit the electronic user manual.

3.6.2 Navigation Tools

Menu item	Description
	[Hide] the Help book navigation tools on the left portion of the screen. To view the left side of the screen again, click the [Show] icon.
	To go back to the previous selected topic.
	To view the topic which was displayed before clicking the [Back] button.
	To print the selected topic or the selected heading and all subtopics.



Choose the desired printer, select the “Page Range” and click the [Print] button.

Caution:

Please be aware that changes and modifications, which are not related to installing printers and adjusting printer settings may cause system dysfunction.

Do NOT change the “Default Printer” setting. This will change also the “Report Printer” setting in the System Setup.



To adjust different functions (e.g. Search Highlight ON/OFF).

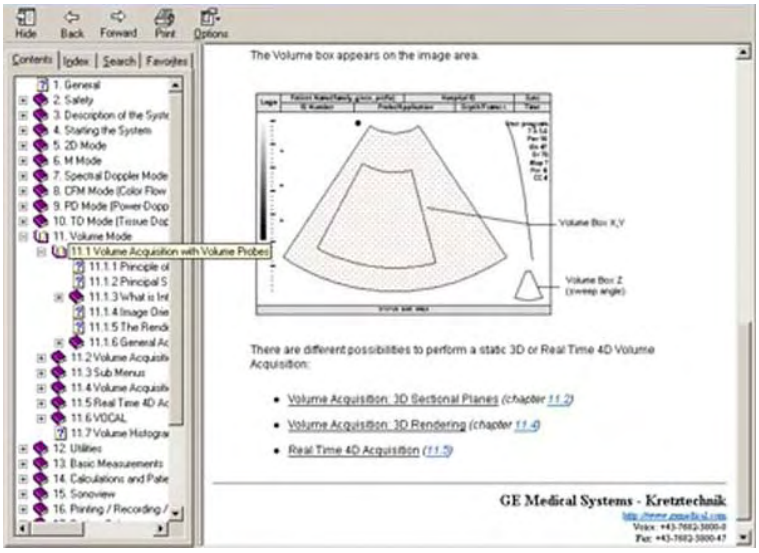
3.6.3 Navigation Tabs

Online Help is organized like a manual, with individual chapters, sections and pages.

Click on one of the Navigation Tabs on the left portion of the screen:

3.6.3.1 To View the Contents

1. Click on the [+] sign next to the chapter you want to view to open up that section.
2. Click on the page to display it in the content pane.

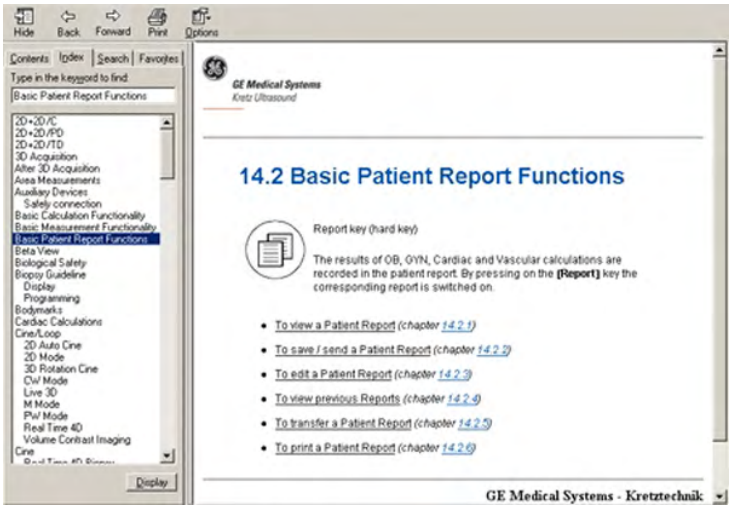


The blue, underlined text links you to related topics.

After you click on the blue, underline text, the screen updates with this link's content. To return to the previous screen click [Back]. To return to the link, click [Forward].

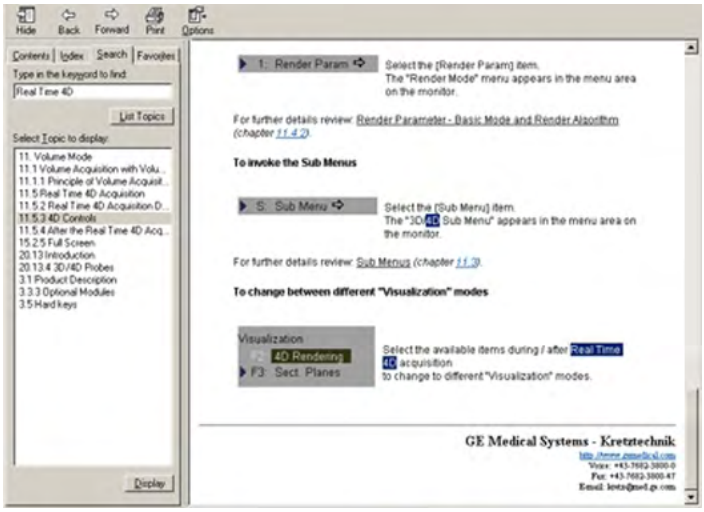
3.6.3.2 To Use the Index

1. Click on the "Index" tab. A list of topics - arranged in alphabetical order - will be displayed.
2. Use the scroll bar to look up a topic.
3. Either double click the desired topic to view, or highlight the topic and click the [Display] button.


Hide
Back
Forward
Print
Options
Contents
Index
Search
Favorites
Type in the keyword to find:
Basic Patient Report Functions
Display
GE Medical Systems
Kretz Ultrasound
14.2 Basic Patient Report Functions
Report key (hard key)
The results of OB, GYN, Cardiac and Vascular calculations are recorded in the patient report. By pressing on the (Report) key the corresponding report is switched on.
To view a Patient Report (chapter 14.2.1)
To save / send a Patient Report (chapter 14.2.2)
To edit a Patient Report (chapter 14.2.3)
To view previous Reports (chapter 14.2.4)
To transfer a Patient Report (chapter 14.2.5)
To print a Patient Report (chapter 14.2.6)
GE Medical Systems - Kretztechnik

3.6.3.3 To Search for a Topic

1. To search for a specific topic, click on the "Search" tab.
2. Type in the topic name in the *Type in the keyword to find:* field. Topics with the word or phrase you typed appear in the *Select Topic to display:* area.
3. Either double click the desired topic to view, or highlight the topic and click the [Display] button.


Hide
Back
Forward
Print
Options
Contents
Index
Search
Favorites
Type in the keyword to find:
Real Time 4D
List Topics
Select Topic to display:
11. Volume Mode
11.1 Volume Acquisition with Volu...
11.1.1 Principle of Volume Acquisit...
11.5 Real Time 4D Acquisition
11.5.2 Real Time 4D Acquisition D...
11.5.3 4D Controls
11.5.4 After the Real Time 4D Acq...
15.2.5 Full Screen
20.13 Introduction
20.13.4 3D/4D Probes
3.1 Product Description
3.3.3 Optional Modules
3.5 Hard keys
Display
1: Render Param
Select the [Render Param] item.
The "Render Mode" menu appears in the menu area on the monitor.
For further details review: Render Parameter - Basic Mode and Render Algorithm (chapter 11.4.2).
To invoke the Sub Menus
5: Sub Menu
Select the [Sub Menu] item.
The "3D/4D Sub Menu" appears in the menu area on the monitor.
For further details review: Sub Menus (chapter 11.3).
To change between different "Visualization" modes
Visualization
F2: 4D Rendering
F3: Sect. Planes
Select the available items during / after Real Time 4D acquisition
to change to different "Visualization" modes.
GE Medical Systems - Kretztechnik

3.6.3.4 To Save a Favorite Topic

You may find that there are topics you need to refer to often. In this case, it is a good idea to save these topics as Favorites.

1. To save a topic as a favorite, click on the “Favorites” tab.
2. Highlight the topic in the *Topics:* field and click the [Add] button.

Now you can access this topic by means of the Favorites tab.

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Chapter 4

Scanning Operations

Describes the first steps from starting the Voluson® i to the scanning with the probes.

4.1 General Remarks

Authorized persons must only perform installation, switching on the first time and check-up of the system.

The Voluson® i is delivered with recommended basic settings. These offer suitable conditions for a large number of applications. Depending on the user's experience these default settings can be changed and stored as new User Programs. Storing these programs or quick loading of new programs of a second user is done by backups.

4.2 Safety Warnings



In the event the equipment has been brought from cold environment (stock room, airfreight) into a warm room, allow several hours for temperature balance and passing of condensation humidity before switching on the first time (risk of leakage current).

4.3 Switching On/Off

To switch on the unit:

1. Make sure a charge battery is in place by checking the power indicator LED, or connect the appropriate AC power supply adaptor output to the rear of the unit.
2. Press (on/off button) on the top right of the control panel ('Mechanical Design' *on page 3-6*).
3. After initialization the default scanning screen (2D mode) is displayed, using the active probe. If the battery is too weak, an appropriate message will display on screen accordingly.

Note *When used with the AC Power Adaptor, the system can be used regardless of the battery level. The battery is automatically charged when the system is operating with the AC Power Adaptor.*

4.4 Switching off the unit

When the Voluson® i is switched off, the system performs an automatic shutdown sequence. The unit can be switched off into two states.

- Standby mode: most of the system is powered down, but a certain portion of the unit remains energized. The standby mode allows a shorter reboot time when the system is used on a daily basis or moved from one place to another.
- Full shutdown: the entire system is shut down. Full shutdown is recommended if the system is not intended to be used for a whole day or longer. It is recommended to perform a full shutdown at least once a week.



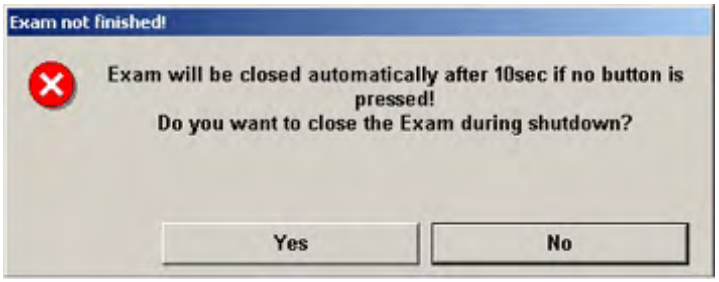
To avoid loss of the current Patient data as well as all the measurements in the Patient Worksheet, it is absolutely necessary to press the **[End Exam]** key on the control panel before switching OFF the system.

For more information see ' End Exam' *on page 4-7.*

Push the ON/OFF Standby switch right on the top of the interface.

For its location review: 'Power requirements' *on page 3-2*.

If the current Exam is not finished, the following warning message will be displayed.


Exam not finished!
Exam will be closed automatically after 10sec if no button is pressed!
Do you want to close the Exam during shutdown?
Yes
No

Remarks:

- After turning off the system, wait at least ten seconds before turning it on again. The system may not be able to boot if power is recycled to quickly.
- The system's fan may run after the system has been shut down.

Full shutdown:

1. Press (on/off button) on the top left of the control panel.

   The Exit dialogue window is displayed.

2. Select Shutdown.

   The shutdown process takes a few seconds and is completed when the control panel illumination is turned off.

Standby Mode:

1. Press (on/off button) on the top left of the control panel. The Exit dialogue window is displayed.
2. Select Standby. The system enters Standby mode. The system remains in Standby mode for approximately system off. 1.5 hours using the internal battery.

Note *When the system is operating, if the power cable is removed from the wall outlet or the Power Adaptor is disconnected from the Voluson® i, the system will continue to operate using the internal battery. When battery power is reduced below a certain level the system automatically shuts down into Standby mode.*

4.5 Transducer Connection

Prior to connecting or disconnecting a probe freeze the image. It is unnecessary to switch the unit off. If a probe is disconnected while running (write mode) a software error may occur. In this case switch the unit OFF and later ON (perform a reset).



1. Plug the probe connector into the probe socket.
2. Push the connector carefully in the socket and lift the locking lever upwards to a full horizontal position to lock the probe.
3. To unplug a probe connector carefully press the locking lever and remove the probe.



Probe connector: shown locked.

Note *A disconnection of an active probe is permitted in read mode **only !!!** If a probe is disconnected while running (write mode) a software error can occur!*

4.6 Probe/Program Selection

This menu shows the connected probes and supported applications. Select a probe and application either by using the trackball or the denoted shortcut key on the keyboard. The active application is indicated by a green dot.

Upon selection of an Application, a maximum of 7 User program fields appear in the [User Settings] field, and a default setting. The DEFAULT Setting is not rewriteable for the User. The “User Setting” selection is also done with the trackball. For each probe up to 7 programs can be stored. User Settings enables speedy adjustment of the system for different fields of application. To store a user setting under an application, review: 'User Settings' *on page 16-8*



[Probe] key (hard key):
This key activates and deactivates the "probe select" menu.
'Transducer Connection' *on page 4-3*



Probe Application selection menu on the screen:

Probe window:

Shows all connected probes, the active one is highlighted (if one is active)

Application window:

Shows all applications for the active probe. The last active application is highlighted.

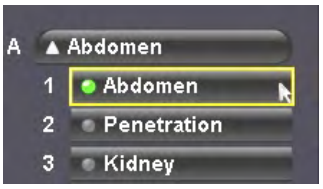
Settings submenu:

Shows all settings for the active application. The last active setting is highlighted.

Selection of a probe:

Select the corresponding probe field using the trackball. Each field shows the name and a picture of the corresponding probe. The selected probe is indicated when it is highlighted. At the same time the application field appears. Upon selection, the programmed user settings come into view. With the trackball select the setting.

4.6.1 Starting the System



Clicking the on the desired application button will load the preset.

The probe is initialized, the main menu (2D mode) and the ultrasound image appears on the monitor in write mode (real time display).



Pressing the **[Freeze]** key causes loading of the selected (highlighted) setting.



Return to the previously used active mode menu (2D mode, M mode, ...) without any changes.

Note *Key **[Exit]** and key **[Probe]** provide the same function. You may exit eventually by one of the keys, if no change of a probe or an application was made. If a change was made in the Application window, then the keys turn dark (disabled). In this case an exit is only possible by selecting [OK].*

4.6.2 To Freeze an Image



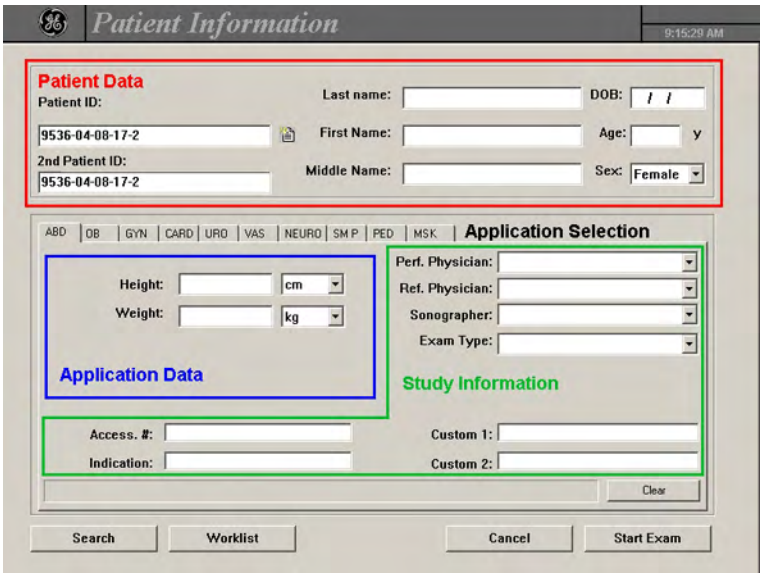
Freeze/Run-key (hard key) Freeze the image by pressing the **[Freeze]** key:
Green key: read mode (image is frozen, probe deactivated)
White key: write mode (real-time is on, probe activated)

4.7 Entering Patient Data

Patient Data is to be entered by using a patient data form. This information will be used in calculations, patient worksheets, DICOM settings and is displayed on the screen to identify images. All entries into the data fields are stored on the internal database.



Press the [Patient] key (hard key) on the control panel.
If there is an active exam the Patient ID Menu appears. *For more information see* 'Patient Menu' *on page 4-8.*
If there is no exam in progress the Patient Information screen appears. *For more information see* '"Patient Information" screen' *on page 4-9.*



Note

- *If the unit is connected to a worklist server (e.g. HIS / RIS) you can select a patient from the list. For more information see* 'To Retrieve Patient Data via External Worklist Server' *on page 4-19.*
- *Otherwise use the keyboard to type in the Patient Information. For more information see* 'Standard Input' *on page 4-17.*

4.7.1 End Exam



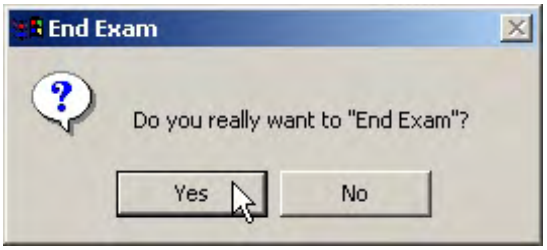
[End Exam] : Exit from the patient procedure to previous operating state.

Patient and measurement data are stored in the "Data manager" and all temporary patient and measurement data are cleared.



It is absolutely necessary to press the **[End Exam]** key on the control panel before switching OFF the system. Otherwise the current Patient data as well as all the measurements in the Patient Worksheets get lost

Alternatively select the [End/New] , [End/Exit] or the [Del/New] item in the Patient ID menu.



If the “End Exam Dialog” field in the System Setup is marked by a check mark the ”End Exam” dialog will be displayed on the monitor before ending the current exam.

'User Settings' *on page 16-8*

1. Incomplete measurements exists:

Select No: Dialog window disappears (exit to previous operating state)

Select Yes: “End Exam” command is executed and the dialog window disappear.

2. No incomplete measurements exists:

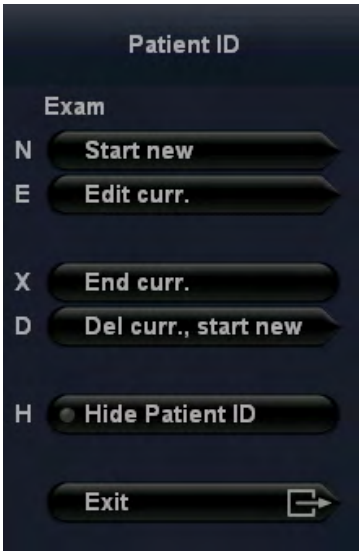
Select No: Dialog window disappears (exit to previous operating state)

Select Yes: “End Exam” command is executed and the dialog window disappears.

- Patient ID exists: Patient and measurement data are stored in the “Data manager” (all temporary patient and measurement data are cleared).
- No Patient ID exists: all temporary measurement data are cleared

Note *The “End Exam” command is also executed if the [End Exam] key/button is pressed again while the dialog window is displayed.*

4.7.2 Patient Menu

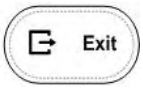


Patient ID Menu display (will only show up if an exam is active and the [Patient] key is selected)

Note *If Patient Dialog is open, it is possible to start and stop recording by pressing the **[VCR]** key.*

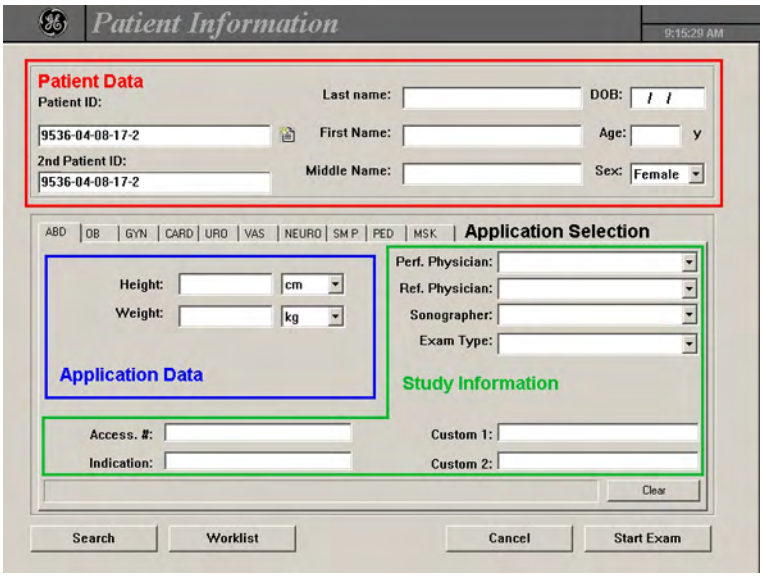
N Start new	Start New: Patient and measurement data are stored in the “Data manager” (all temporary patient and measurement data are cleared) and the Patient information page is displayed.'“Patient Information” screen' *on page 4-9* If MPPS is used, and a step is in progress, send MPPS complete message to complete the step.
X End curr.	End curr.: Patient and measurement data are stored in the “Data manager” (all temporary patient and measurement data are cleared) and the system returns to scanning screen. If MPPS is used, and a step is in progress, send MPPS complete message to complete the step
D Del curr., start new	Delete Exam / New ID: All temporary Patient and measurement data are cleared and Patient information page is displayed.'“Patient Information” screen' *on page 4-9* If MPPS is used, and a step is in progress, send MPPS discontinue message to cancel the step.
E Edit curr.	Edit Patient Info:'“Patient Information” screen' *on page 4-9*
H Hide Patient ID	Hide Patient ID: The patient name and ID title bars on the scanning screen are replaced with dots.

Note *The ID number cannot be edited. If 3D/4D data are loaded from SonoView back into the system, editing is impossible (the [Edit] key is grayed).*



Exit from the patient procedure to previous operating state without changes.

4.7.3 “Patient Information” screen

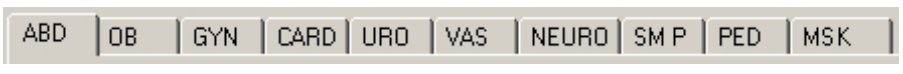


1. Enter Patient Data.

Patient ID:	ID number	max. 32 characters
2nd Patient ID:	Additional ID number (only available if checkbox is activated in the System Setup)	max. 64 characters, depends on system settings
last Name:	patient’s last name	max. 32 characters
First Name:	patient’s first name	max. 15 characters
Middle Name:	patient’s middle name	max. 15 characters
DOB (Day of Birth)	patient day of birth	
Age	patient age	
Sex	---- , female, male (selection in pull down menu)	

Note *Upon entering the day of birth: The age is calculated and displayed automatically.*

2. Select Application.



- Abdomen (ABD)
- Obstetrics (OB)
- Gynecology (GYN)

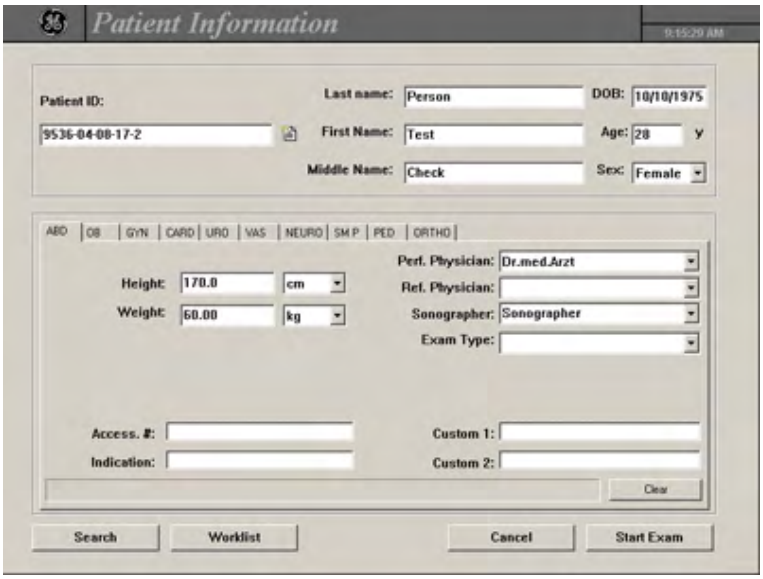
- Cardiology (CARD)
- Urology (URO)
- Vascular (VAS)
- Neurology (NEURO)
- Small Parts (SM P)
- Pediatrics (PED)
- Muscoloskeletal (MSK)

3. Enter the required Application Data for the selected Application.

4. Enter additional Study Information.

Perf. Physician:	Name of the Performing Physician	max. 32 characters
Ref. Physician:	Name of the Referring Physician	max. 32 characters
Sonographer:	Name of Sonographer	max. 32 characters
Exam Type:	comment input	max. 32 characters
Accession #	accession number	max. 16 characters
Indication:	Indication	max. 32 characters
Custom 1:	custom input field 1	max. 32 characters
Custom 2:	custom input field 2	max. 32 characters

4.7.3.1 Patient Information – Abdomen (ABD)

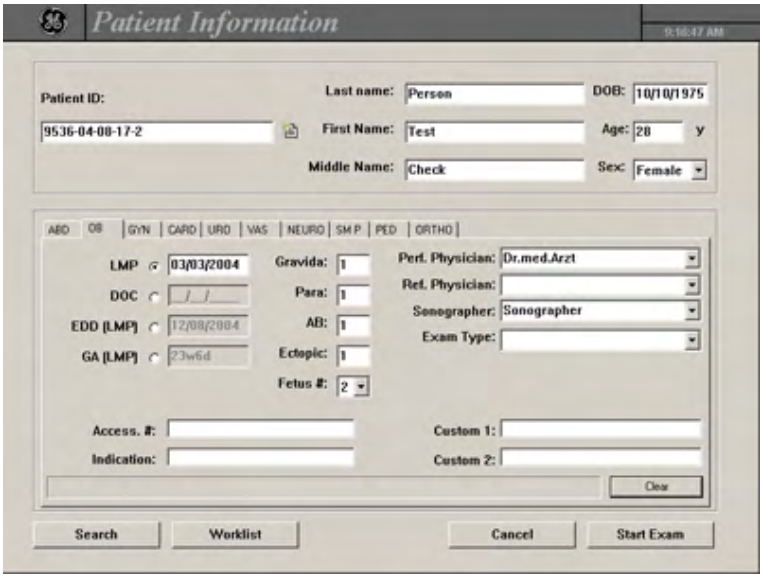


Application Data:

Height:	Enter the patient's height in one of the units (cm, ft, inch).
Weight:	Enter the patient's weight in one of the units (kg, lb, oz).

Unit selection: Position the cursor into the unit selection field using the trackball and press the left or right trackball key. The different units will appear (in a successive order) for selection.

4.7.3.2 Patient Information – Obstetrics (OB)



Application Data:

LMP

Enter the date of the last menstrual period using the selected format (e.g., mm-dd-yyyy).

Note *The first day of the last period must be entered.*

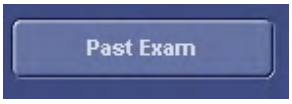
DOC	Enter the date of conception.
EDD	Enter the estimated date of delivery, GA is calculated automatically.
GA	GA will be calculated automatically after entering the date of the last menstrual period (LMP) or the estimated date of delivery (EDD). When entering the Gestational Age (GA), EDD (and DOC) is calculated automatically.
Gravida	Enter the patient's history of pregnancies.
Para	Enter the patient's history of live births.
Aborta	Enter the patient's history of abortions.
Ectopic	Enter the patient's history of ectopic pregnancies.
Fetus #	Enter the fetus number (e.g., at twins "2").

Note

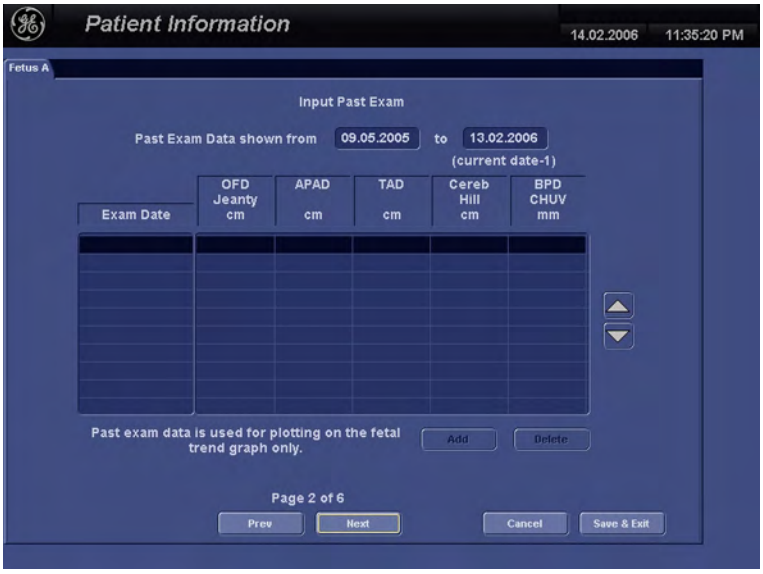
- *When entering LMP, the GA and EDD fields automatically show the calculation results.*
- *When entering GA only EDD is calculated; when entering EDD only GA is calculated.*

LMP/GA/EDD calculation

Duration of gestation:		280 days
EDD	=	LMP + 280d
GA	=	actual date – LMP (actual date = date of Voluson® i)
LMP	=	EDD – 280d



Select this button to invoke the Past exam dialog. (Only available if application is OB)



It is possible to switch between fetus tables, if more than 1 Fetus is entered in the patient dialog page.

Note *This dialog is used to enter data from previous ultrasound exams, performed on other systems. This data can then be used for fetal trending (graphs).*

Note *Which measurements are listed depends on the current measure setup settings. On all further pages the measurement columns change but the exam date column remains the same.*

If no LMP is available the system uses the current date – the length of pregnancy used for calculations.



This field shows the start and the end date of the Exams.



Create a new entry by entering an exam date (values between actual date and LMP are possible).



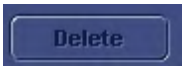
Enter measurement data from previously performed exams.



If there are several exams listed, use the “Up/Down” arrows to scroll through the list.

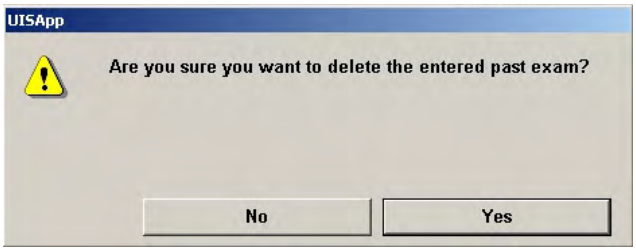


Use these buttons to go to the previous or next page of measurements.

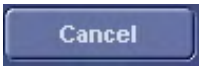


Use this button to delete the entry.

Following message appears:



Select [Yes] if you want delete exam, slect [No] if you want to proceed.



Use this button to return to patient dialog page without saving data.



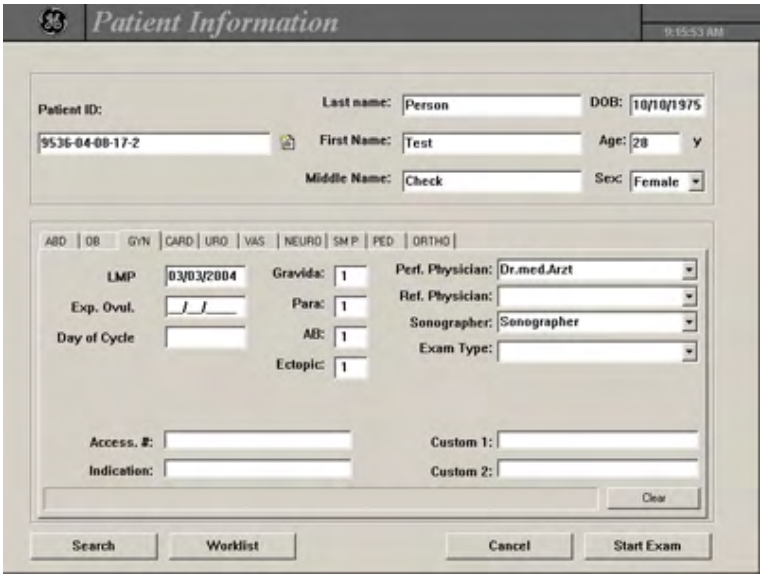
Use this button to return to patient dialog page and save data.

Note *Only data that was entered via the past exam dialog is shown. (Measurements from exams performed on this machine are not listed).*

Note *Data that was entered via the past exam dialog page is to be used in the fetal trending and those exams will be listed in the previous report section as well.*

Note *For more information see* 'Summary Report - Graph' *on page 13-34.*

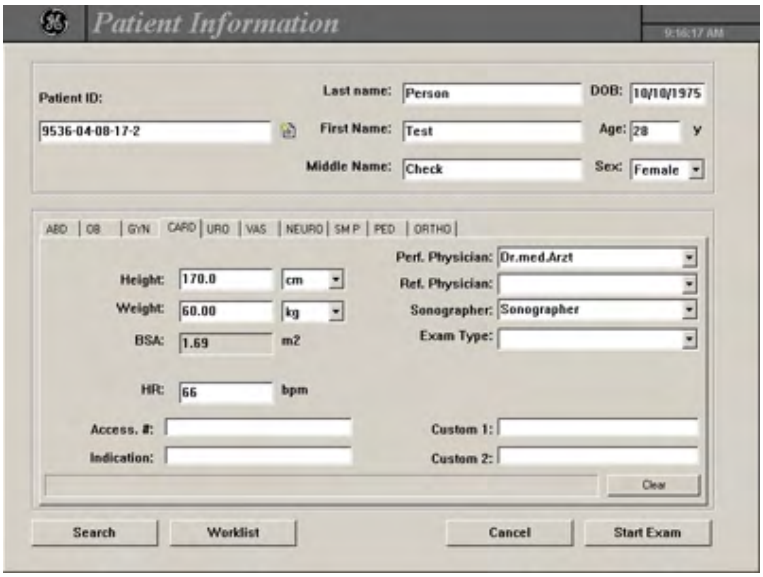
4.7.3.3 Patient Information – Gynecology (GYN)



Application Data:

LMP	The first day of the last menstrual period must be entered using the selected format (e.g., mm-dd-yyyy).
Exp. Ovul.	Date of expected ovulation
Day of Cycles	Day of cycles
Gravida	Enter the patient's history of pregnancies.
Para	Enter the patient's history of live births.
Aborta	Enter the patient's history of abortions.
Ectopic	Enter the patient's history of ectopic pregnancies.

4.7.3.4 Patient Information – Cardiology (CARD)



Application Data:

Height	Enter the patient's height in one of the units (cm, ft, inch)
Weight	Enter the patient's weight in one of the units (kg, lp, oz)
BSA	Body Surface Area (calculation value, no input)
HR	Heart Rate

Unit selection: Position the cursor into the unit field using the trackball and press the left or right trackball key. The different units will appear (in successive order) for selection.

Note *The BSA value is calculated automatically, after entering height and weight.*

Note *If Height and/or Weight are entered in other units (inch, lb), first convert to kg and cm before calculation of the BSA can take place!*

Calculation formula for BSA:

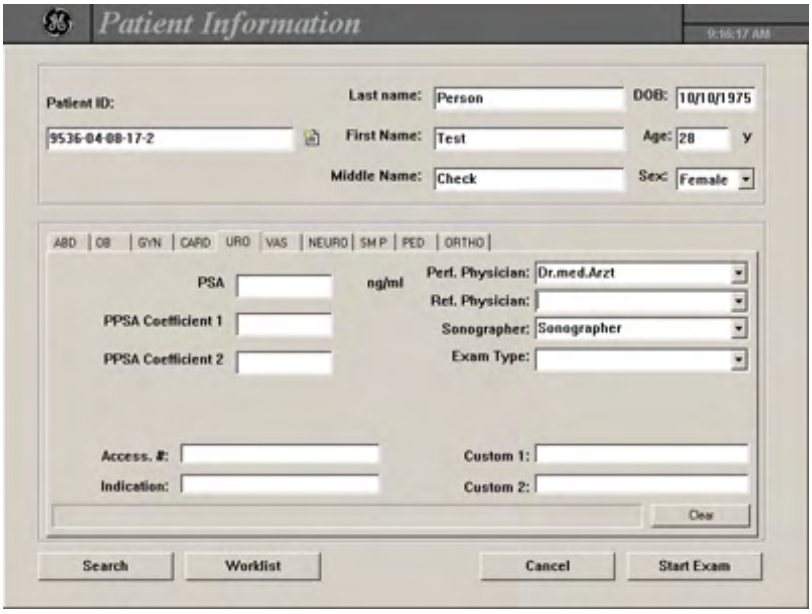
$$BSA = WT^{0.425} \times HT^{0.725} \times 10^{-4} \times 71.84$$

WT [kg]

HT [cm]

BSA [m²]

4.7.3.5 Patient Information – Urology (URO)



Application Data:

PSA	Enter the value of the Prostate-specific antigen
PPSA Coefficient 1	Enter the 1st value of the predicted PSA Coefficient.
PPSA Coefficient 2	Enter the 2nd value of the predicted PSA Coefficient.

Note *The PPSA is a number in units of ng/ml/grams which gives the normal level of PSA that would be expected for a prostate of a given volume. Predicted PSA = Volume (grams) x 0.15ng/ml/g (the Coefficient factor is adjustable in the Measure Setup)*

4.7.3.6 Patient Information – Vascular (VAS)

No specific Application Data Entry.

4.7.3.7 Patient Information – Neurology (NEURO)

No specific Application Data Entry.

4.7.3.8 Patient Information – Small Parts (SM P)

No specific Application Data Entry.

4.7.3.9 Patient Information – Pediatrics (PED)

No specific Application Data Entry.

4.7.3.10 Patient Information – Musculoskeletal (MSK)

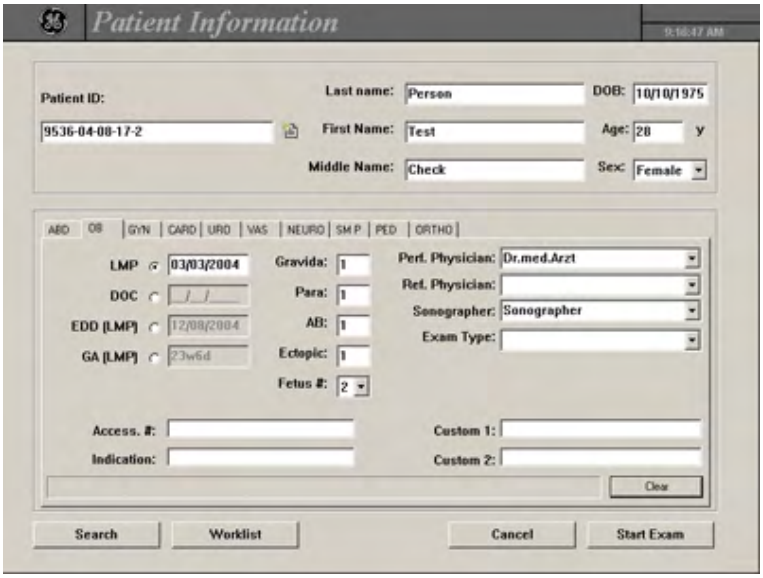
No specific Application Data Entry.

4.7.3.11 Edit Patient Info



Select the [Edit] item, which is available in the Patient ID Menu. *For more information see* 'Patient Menu' *on page 4-8.*

Note *If 3D or 4D data are loaded from SonoView back into the system, edit is impossible (the [Edit] item is grayed).*



For more information see 'Standard Input' *on page 4-17.*



Continue the actual Exam:

The patient info is temporarily stored. The Edit Patient Info procedure is closed and the previous operating state is activated.

Note *The ID number cannot be changed!*

4.7.4 Standard Input

1. SELECT AN INPUT FIELD

There are 2 possibilities to select an input field:

1.) by means of the trackball

2.) by means of the keyboard

1.) Input field selection possibility:



Trackball: position the cursor in the input field

Enter: select an input field; press the right or left trackball key

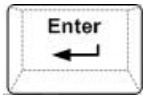
2.) Input field selection possibility:

Press the **[Enter]** or **[Tab]** (input fields are selected in a successive order).

2. ENTER PATIENT INFO



Use the keyboard to type the patient info.

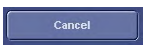


Upon pressing the **[Enter]** key on the keyboard the data is entered and the next input field is selected.

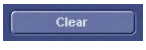
Note *If the "Capitalize Letter in Patient Names" field in the System Setup is marked by a check mark the first letter in the "Name" fields will be automatically capitalized.* 'User Settings' *on page 16-8*

Note *The system creates automatically a Patient Identification (ID) number. To create your own ID number, overwrite the automatic ID number using the keyboard. Patient data on different systems are only distinguished by the Patient Identification (ID) field! If you do not use the default auto-generated ID please make sure that this identification (ID) is unique on all systems for the same patient!*

3. MENU CONTROL KEYS



Exit from the patient procedure to the previous operating state. The patient info previously entered will be cleared.



Clear the patient information. The ID field is to be selected for new input.

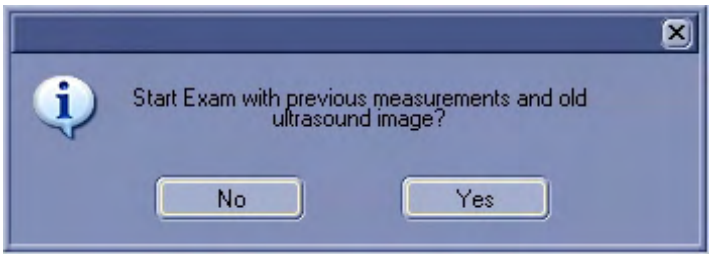


The patient info is temporarily stored. The Input procedure is closed and the previous operating state is activated.



”Start Exam” is also possible by pressing the **[2D]** key or **[Freeze]** key on the control panel.

If measurements have been done without populating the Patient Information page first, thers is no save/send in progress and auto-start acquisition is disabled, the system will display an info dialog“ Start Exam with previous measurements and old ultrasound image?” on the monitor.



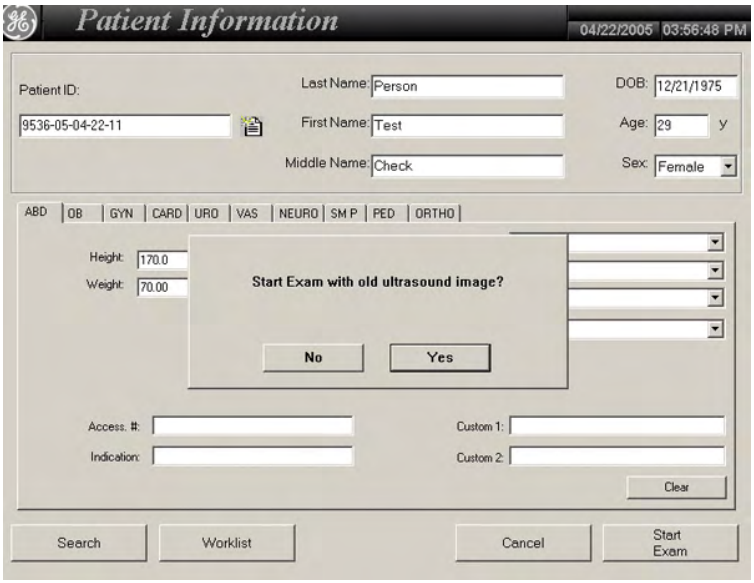
To quit the dialog:

[Yes]: The actual measurements are dedicated to the Exam.

[No]: The actual measurements and the screen are cleared and 2D starts.

The Patient procedure is closed and the previous operating state is activated.

Note *If Auto Start Acquisition is selected, the system automatically starts a new acquisition in 2D Mode when Start Exam is pressed, without displaying the dialog.* 'User Settings' *on page 16-8*



To quit the dialog:

[Yes]: The exam starts with the last image) displayed.

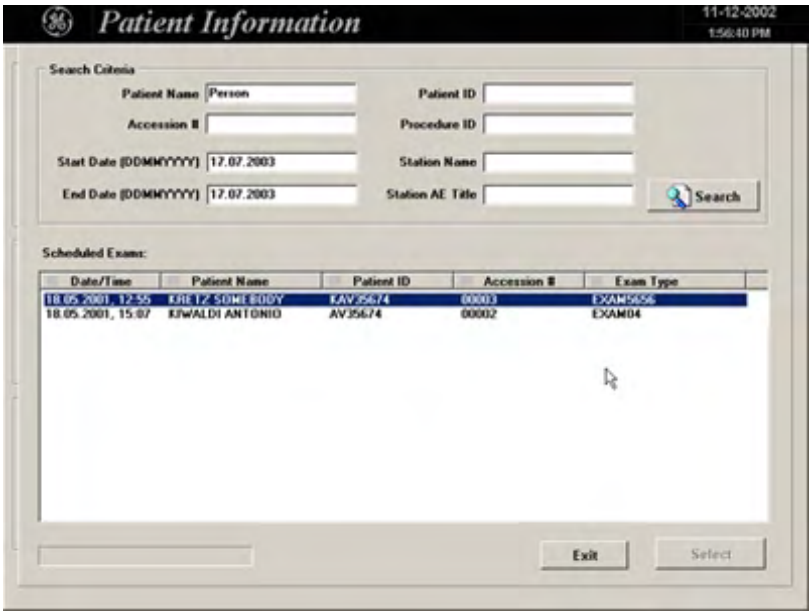
[No]: The screen is cleared and 2D is activated.

The Patient Information dialog is closed and the previous operating state is activated.

4.7.5 To Retrieve Patient Data via External Worklist Server



Select the [Worklist] button to view the available Data from the external worklist server. This button is available in “Patient Information” screen. '“Patient Information” screen' *on page 4-9*



Select the desired “Search” field with the trackball.



Click this button to search for the corresponding input.

Note *If a procedure with more than one procedure step is retrieved from the worklist, only one entry is created. The number of steps is given in the S# column.*

Highlight the result using the trackball cursor and the left or right trackball key [Set].

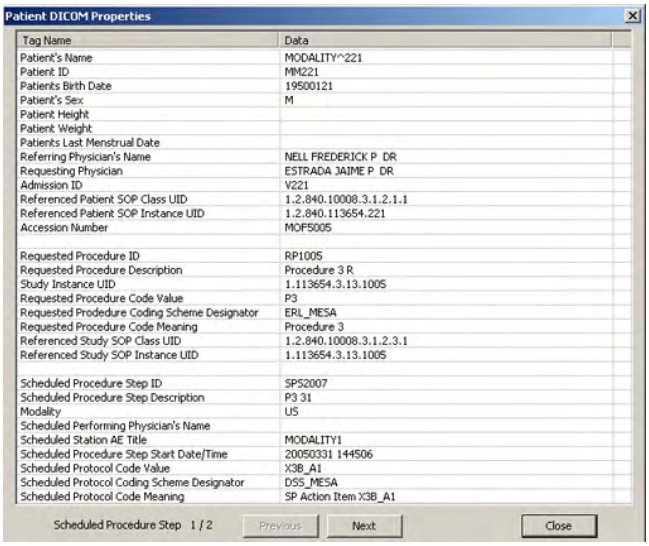


The search result will be copied to the patient dialog screen.

Following actions are possible, if MPPS Server is available and procedure information available:

1. Highlight an entry from this list using the trackball and press the middle trackball button.

Detailed DICOM information is displayed:





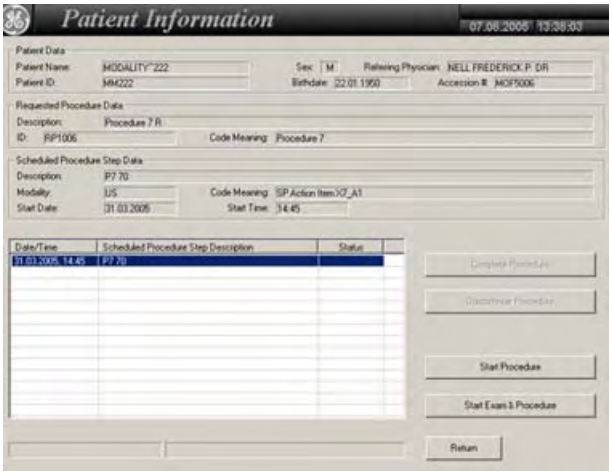
Select one of this buttons to navigate through the detailed DICOM information of the relevant procedure steps.



Select the [Close] button to return to worklist.

2. Highlight an entry from this list using the trackball and press the [Select] button.

The “Procedure Step” dialog is displayed:



Note *The procedure step dialog lists all procedure steps belonging to the selected procedure.*

Note *The header section displays the most important information of the selected step.*

Highlight an entry from this list using the trackball and press the middle trackball button.

Detailed DICOM information is displayed.

The status of a step can be none (not started), in progress, completed or discontinued.

Complete Procedure	Select this button to complete the step by sending a MPPS complete message (only possible if status of step is “in progress”).
Discontinue Procedure	Select this button to cancle a stem by sending a MPPS discontinue message (only possible if status of step is “in progress”).
Select Procedure	Select this button to start the procedure not immediately, but only after pressing “Start Exam” in the patient dialog (only possible if no other step is “in progress” and status of step is not started).
Start Exam & Procedure	Select this button to start exam immediately without returning to the Patient dialog (only possible if no other step is “in progress” and status of the step ios not started.
Start Procedure	Select this button to start the step immediately (only possible if no other step is “in progress”).
Return	Select this button to return to worklist dialog or to the patient menu (depending on where the procedure step was started from).
Exit	Exit from the Worklist search screen. No result will be copied.

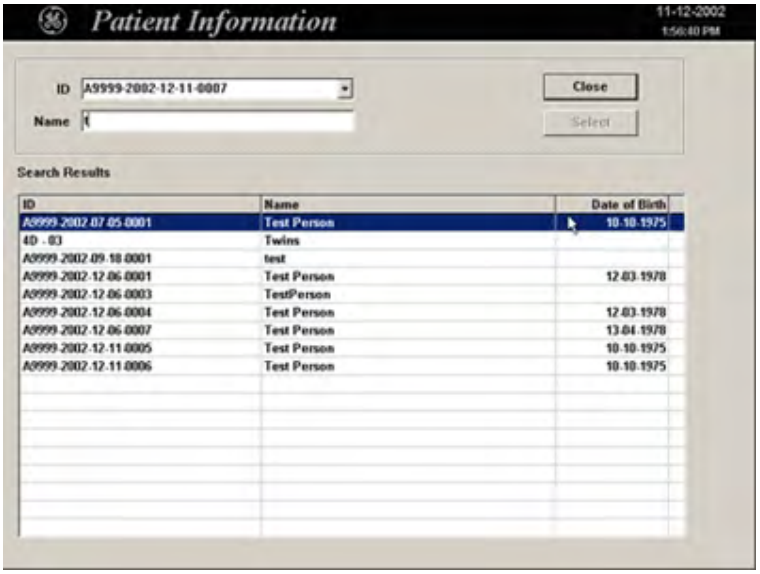
Note *The [Worklist] button can only be selected if a “Worklist Service” DICOM address is specified in the System Setup.* 'To Specify a DICOM Address' *on page 16-27*

4.7.6 To Search in the Patient List

Search — Select the [Search] button using the trackball cursor and enter with the left or right trackball key.

This button is available in “Patient Information” screen. *For more information see* '“Patient Information” screen' *on page 4-9.*

The “Search Results Dialog” menu appears on screen.



Search procedure:

- Enter ID or Name into the corresponding input field by the keyboard keys.
- Select the result using the trackball cursor and the left or right trackball key. The result is highlighted. Double-clicking selects and copies the result immediately to the “Patient Information” screen.
- or click the [Select] button

Select The search result will be copied to the patient dialog screen. The “Patient Information” screen appears again. *For more information see* '“Patient Information” screen' *on page 4-9.*

Close Exit from the search dialog screen, no result will be copied. The “Patient Information” screen appears again.*For more information see* '“Patient Information” screen' *on page 4-9.*

4.8 Image Annotation



[Text] - Text key (hard key) Press this key to start the documentation function. Upon pressing once more the text is switched off but the written text is not cleared.

There are two possibilities provided to add text to an image:

- 'Annotation' *on page 4-22*
- 'Auto Annotation' *on page 4-23*

4.8.1 Annotation

This function enables text writing onto the ultrasound image using the keyboard, in read mode or in write mode, respectively. The inscription will be erased upon selection of a probe or a program. Inscription is not possible outside the annotation area.

Operation:

1. Activate the Annotation Mode via **[Text]** key.
2. Write the text desired using the keyboard.

Remarks:

- The position of the cursor (“Home” position) can be changed by either:
  - Trackball
  - **[Arrow]** keys (left, right, up, down),
  - **[Enter]** key (next line), or
  - **[Backspace]** key (deletes the last character)

  The Trackball, the [Home] key, or the arrow keys on the keyboard can set the left margin of the image annotation.

4.8.2 Auto Annotation

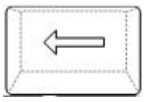
This function is provided to rapidly insert terms into the display image. 40 words for each application are user-programmable. Programming of the TEXT AUTO function review: 'User Settings' *on page 16-8*.



Operation:

1. Activate the Text Mode via **[Text]** key. The auto text menu appears in the menu area.

2. Select a “word” with the navigation wheel and press it. The first word appears at the cursor position. Select a new word (a "blank" is inserted between the old and new word), or enter a character using the keyboard (a "blank" is inserted between the old word and the new character).



Press the **backspace** key to delete the last freely entered letter or auto text word.

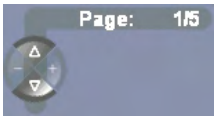


Press either the **[Del]** key on the keyboard or the **[Clear]** key on the control panel to delete all the entered text.





Text function is switched off but the entered text is not cleared. Return to the last active menu.



With this flip switch you can select either 1st or 2nd page of words.



Select different application-related terms.



After selecting another application the menu changes back to the text menu with the auto text words of the selected application.

Note *The main application (chosen in the "Probe Selection" menu) does not change! After selecting the [Application] item the menu area changes to the "Application" menu. When a "main" application in the "Probe Selection" menu is selected, the text application is set (changed) to this application.*

Remarks:

- The position of the cursor ("Home" position) can be changed by either:
  - Trackball
  - **[Arrow]** keys (left, right, up, down),
  - **[Enter]** key (next line), or
  - **[Backspace]** key (deletes the last character)

  The Trackball, the [Home] key, or the arrow keys on the keyboard can set the left margin of the image annotation.

4.8.3 Indicator



Indicator key (hard key) Pressing the **[Arrow]** key causes the menu area to change to the Indicator menu. The last used Indicator (or by default the first indicator on the menu) appears on the screen.



Operation:

1. Switch on the indicator function (hard key). The last selected indicator appears in the middle of the annotation area.

2. Select the shape of indicator you want, or use the indicator, which has appeared.

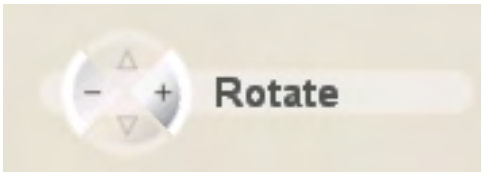
3. Position the indicator using the trackball.

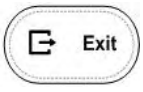
4. Adjust the direction of the indicator (digipot , 360º rotation possible).

5. Enter the indicator by pressing the right or left trackball key [Set].

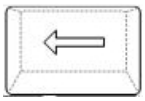
6. A new indicator is set by repeating procedures **3**. through **5**. When the trackball is moved the next indicator appears.

To rotate the Arrows:





The Indicator function is switched off but the previous entered indicator remains uncleared. Return to the last active menu.



Press the **backspace** key to delete the latest fixed indicator and any subsequent ones thereafter..



Press either the **[Clear]** key or the **Del** key on the keyboard to delete all but the active indicator.

4.8.4 Bodymarks

Pictogram Display (body marks)

For the documentation of the scan position on the patient, a selection of graphic body symbols (bodymark) is available. A short bright line indicates the scan position. This line can be positioned freely on the bodymark symbol.

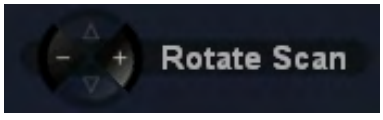


Pressing the **[Body]** key causes the menu area to change to the bodymark menu. The previously used bodymark is shown on the screen.

Operation:



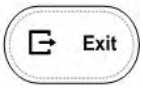
1. Press the **Body** hard key. The latest selected pictogram is displayed in the latest used position.
2. To change the displayed pictogram, press the cursor key and select the appropriate pictogram.
3. Position the scan plane identification line with the trackball.



4. Adjust the direction of the mark by means of the **Menu-Softbuttons**.
5. Press the **upper trackball key** to switch between moving and rotating the scan plane identification line.

6. Press the left or right trackball key [Set] to fix the scan plane identification line and return to the last active menu with the displayed bodymark.

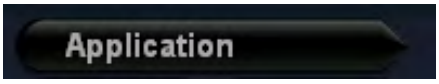
Note *The scan plane identification is shown in the write mode and the read mode.*



Return to the last active menu with the bodymark displayed.



Return to the last menu with the bodymark switched off.



Changes between the different application-related bodymarks.



After selecting another application the menu changes back to the bodymark menu with the bodymark symbols of the selected application.

Return to the Bodymark menu, if no new application is selected.

Please note: The main application (chosen in the “Probe Selection” menu) does not change! After selecting the [Application] item the menu area changes to the "Bodymark Application Select" menu. When a "main" application in the “Probe Selection” menu is selected, the Bodymark application is set (changed) to this application.

Note *The scan plane identification is shown in the write mode and the read mode.*

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Chapter 5

2D Mode

Describes the 2D mode and its features

2D Mode

The 2D display consists of the ultrasound image, an orientation marker, patient data, image information, a Gray scale pattern, a depth scale with focal zone markers and an actual TGC curve.

The ultrasound image is derived from the tissue echoes that return to the scanhead. They are amplified, converted and then mapped to an image processing curve that relates each echo's intensity to a shade of gray. The greater the echo intensity, the brighter the shade of gray. As each echo is received, it is arranged along a line within the ultrasound image display. The location along the line that is displayed is related to the depth at which the echo occurs.

The 2D mode chapter is subdivided in two groups in which you will see how to use 2D mode and how to adjust the 2D settings.

To use the 2D mode review: '2D Main Menu' *on page 5-2*

To adjust 2D setting review: '2D Sub Menu' *on page 5-22*

To use special 2D display modes and functions, review:

- 'Harmonic Imaging (HI)' *on page 5-7*

5.1 2D Main Menu



[2D Mode] key (hard key)
Press this key to change from another mode to 2D mode display.
To adjust 2D setting review: '2D Sub Menu' *on page 5-22*
The 2D Main menu appears on the screen. (write mode)



Remarks:

- Changing the Angle, Beta View, Focal Zones, OTI, Frequency, Trapezoid mode(and combinations of these modes) is only possible in real time mode.
- The functions Focal Zones, OTI, Angle, Frequency, FFC, CE and Trapezoid mode only appear if they are available for the selected probe.
- The Trapezoid mode is only available with linear probes.

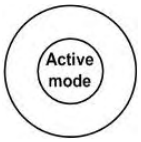
5.2 2D Operation

The 2D operation consists of:

- '2D Gain' *on page 5-3*
- '2D Mode Depth' *on page 5-3*
- '2D Image Angle' *on page 5-4*
- 'TGC Slider Controls' *on page 5-4*
- '2D Automatic Optimization' *on page 5-5*
- 'Transmit Power' *on page 5-5*
- 'Transmitter Focus' *on page 5-6*
- 'Receiver Frequency Range' *on page 5-7*
- 'Harmonic Imaging (HI)' *on page 5-7*
- 'Focus and Frequency Composite (FFC) ' *on page 5-25*
- 'Trapezoid Mode' *on page 5-8*
- 'Image Orientation' *on page 5-8*
- 'Multi Format' *on page 5-9*
- 'Cine Mode' *on page 5-11*

5.2.1 2D Gain

With the “Gain” control the overall brightness of the 2D image is adjusted. The adjustment of the gain control determines the amount of amplification applied to the received echoes. All incoming echoes are amplified with the same gain value regardless of depth.



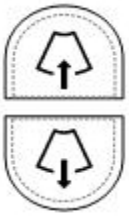
[Active mode] key – rotate it to adjust the sensitivity (brightness) of the entire image. When the GAIN control is turned clockwise the entire image becomes brighter. When the GAIN control is turned counterclockwise the entire image becomes darker.

Remarks:

- The actual gain value is displayed on the screen [GN ...]

5.2.2 2D Mode Depth

With this function the depth range of the ultrasound image for the region of interest is adjusted. The number of image lines and the frame rate are automatically optimized. Changing of the depth is only possible in real time (write mode).



When the **[Depth]** control is pressed downwards, the depth range of the 2D image is enhanced and the display size of the image is reduced to view the entire depth range. When the **[Depth]** control is pressed upwards, the depth range of the 2D image is reduced and the display size of the image is magnified.

When you change the Depth, the 2D image display, the depth scale, acoustic power indices (MI, TIS, TIB, TIC), frame rate, and focal depth will change accordingly.



Remarks :

- The maximum and minimum depth depends on the selected probe. The actual depth in [cm] is displayed in the Information Header.
- Read mode: The displayed 2D image is positioned again on the monitor without change in the depth range.

5.2.3 2D Image Angle

Use the Menu control to select a part of interest of the 2D image. The advantage of the decreased field-of-view is an increased 2D frame rate due to the smaller sector width.



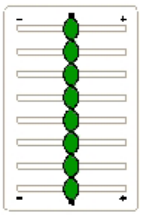
Press + to increase the image width. Press - to decrease the image width.

Remarks :

- If the selected probe has the possibility to adjust the 2D angle, the Menu control will show its value.

5.2.4 TGC Slider Controls

The “TGC slider controls” vary the gain in certain depths of the 2D image to allow an exact compensation for the attenuation of the echoes over time (depth).



TGC slide controls to selectively adjust the sensitivity (brightness) in depth Slide a slide control to the left to decrease the gain in the corresponding specific 2D depth. Slide a slide control to the right to increase the gain in the corresponding specific 2D depth.

Remarks:

- The standard adjustment of the sliders is the middle position because of the preset time gain compensation for each scanhead.
- The setting of the sliders is not stored in an user program, because of the absolute position of the sliders.

5.2.5 2D Automatic Optimization

This function will optimize the contrast resolution according to the histogram of the scan area. The shape of the ROI will depend on the probe, scan depth and scan angle. The primary result is a value for the left and right endpoint of the actual histogram.



Pressing the **[auto]** key causes automatic optimization of the gray scale to enhance the contrast resolution. When the key is pressed again, the optimization according to the histogram will be updated and remain active.

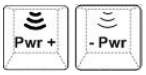
Press the **[auto]** key twice to switch off the Automatic Optimization of the 2D mode image.

Remarks:

- When the Automatic Optimization function is active, the [auto] key is brightly illuminated.
- When Automatic Optimization is active, an asterisk (***** nearby the Gray map number) is displayed in the B mode Image Info area. For example: C5 / M7*****
- The Automatic Optimization is also possible in Pulsed Wave (PW) Doppler mode. *For more information see* ' PW Automatic Optimization' *on page 7-5.*
- The Automatic Optimization is also possible in 3D/4D mode. *For more information see* 'Sectional Planes' *on page 10-41.*
- In CFM, PD the optimized settings for the 2D image are kept, but the **[auto]** function is disabled.

5.2.6 Transmit Power

The [Power] buttons governs the acoustic output of the transducer. It shall be set to the minimum value which still allows well evaluable information. Always keep the power level and the exposure time **A**S **L**OW **A**S **R**EASONABLY **A**CHIEVABLE.



Use the **[Power-]** key to decrease and the **[Power+] key to increase** the amount of acoustic output.

Remarks :

- The actual transmit power value is displayed in the monitor's Image Information area.
- The maximum possible acoustic output can be reduced by this control function, if certain values of Mechanical and Thermal Indices are exceeded.
- The adjustment of transmit power output changes also the actual output adjustment of all other modes.

5.2.7 Compound Resolution Imaging (XBeam CRI)

In this special 2D mode, pulses are transmitted not only perpendicularly to the acoustic window, but also in oblique directions. 3, 5, 7, 9, or 11 angles are correlated for one frame. The advantages of CrossBeam Compound Resolution Imaging (XBeam CRI) are enhanced contrast resolution with better tissue differentiation and clear organ borders. Also vessel walls and tissue layers are emphasized for easier recognition.



Switch on the [XBeam CRI] function in 2D mode using the button in the menu area.

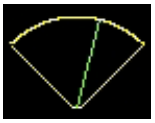
Remark:

- If the [XBeam CRI] function is enabled in 2D Mode, it is also used in 3D preparation mode and during a Static 3D acquisition.

5.2.8 Beta View (β View)

This function is available only with certain 3D Probes. Please see 'Imaging Modes' *on page 18-6* for further information.

The "Beta View" function allows the adjustment of the Volume O-Axis position of 3D probes in 2D mode.



The green line in the displayed symbol indicates the position of the acoustic block, the yellow box indicates the field of view.

Note *The symbol appears only when the Beta View angle has been manipulated.*



Press the up and down soft buttons to adjust the position of the acoustic block. The field of view can be adjusted by means of the + and - soft buttons.

5.2.9 Transmitter Focus

The selected focal zone determines the depth range of optimized sharpness of the ultrasound beam. The [Foc Num] field in the status area displays the actually set number of focal zones for transducers which allow to change focal zones.



Use the [Foc Num] Menu button to select the number of focal zones. The possible number of focal zones depends on the probe in use. Use [+] and [-] for changing the Foc Num. Arrows at the left side of the 2D image mark the active focal zones by their position.

Use the [Foc Depth] Menu button to select the depth position of the actual focus zone(s). Use the [up] and the[down] buttons to change the Foc Depth. The marker arrows mark the depth position of the focal zone(s).

Remarks :

- After selection of focal zones the maximum possible acoustic output can be adequately reduced.
- The more focal zones that are set, the lower the frame rate.

5.2.10 Receiver Frequency Range

The “Frequency range” function allows for the fast adjustment of high resolution/ lower penetration, mid resolution/ mid penetration, or lower resolution/ high penetration for the 2D image. From the transducer’s broadband signal a certain start frequency and start bandwidth is extracted and then continuously changed over depth. Every transducer has a set of three fixed receive settings which are easily controlled by using the [Freq] Menu control.



Use the [Freq] Menu control to adjust the range of the receive frequency. Three positions are possible: Resolution, Normal, Penetration

Remarks:

- The selected frequency range is displayed on the status area.
- The frequency range is displayed in 2nd line of the B mode Image Info area: e.g.: 7.5 - 5.0Mhz 7.5 ..... start frequency 5.0 ..... end frequency

5.2.11 Harmonic Imaging (HI)

Tissue not only scatters back echoes with the nominal transmitted frequency but also with double, threefold, fourfold and so on (harmonic) frequencies, as a result of a physical effect called “non-linear propagation”.

Coded Harmonic Imaging delivers better grayscale contrast compared to standard ultrasound imaging. This technique has proved to be particularly useful for difficult-to-image patients and furthermore is less prone to artifacts.



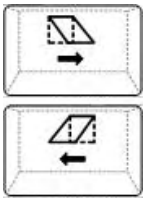
Switch on / off the “Coded” [Harmonic Imaging] function in 2D mode.

Light illuminated:	Harmonic is active (receiving frequency is the double of the transmitted frequency).
Weak illuminated:	Harmonic is usefully with the selected probe, but not active (the last adjusted transmitting frequency is active).
Not illuminated:	The use of Harmonic Imaging is impossible with the selected probe.

Remarks:

- The Harmonic frequency setting is displayed in 2nd line of the B mode Image Info area.

5.2.12 Beam steering



Use this buttons to change the direction of insonification as indicated on the hardkey. This direction is controlled by a phased array in which several of the transducer elements are fired at slightly different times, so that the combined beam focuses at a given location.By shifting the delay at each element, it is possible to steer the ultrasound beam so that it effectively fires at an angle to the transducer, rather than in an orthogonal direction.

Beam steering is particularly helpful for Doppler imaging and scanning of body parts which do not allow for intense tilting of the probe (e.g. throat).

5.2.13 Trapezoid Mode

Advantage of the Trapezoid mode: The scan area is increased in relation to the linear display by steering the ultrasound lines in the border of the probe.



Select Trapezoid mode in the menubar. The Trapezoidmode is illuminated and active.

Remarks:

- These selection-fields appear automatically in the 2D mode menu, if the selected probe is capable of Trapezoid mode.
- Trapezoid mode is possible in Doppler- and Color mode without restrictions.

5.2.14 Image Orientation

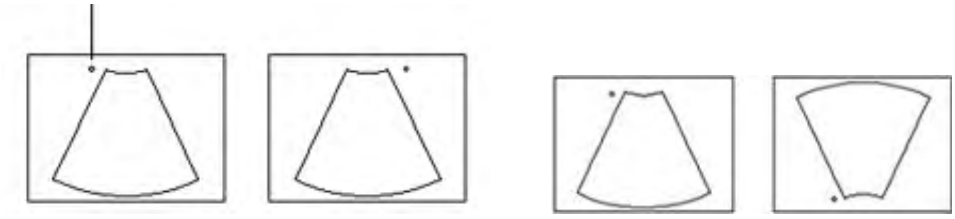
With this function the image orientation on the screen in relation to the patient is alternated between left and right without rotating the scan head itself. The orientation marker shows the actual orientation. 'Probe Orientation' *on page 18-9*



Press the **[left/right]** key on the control panel to alternate between left and right image orientation.

Left / Right **Up / Down**

Orientation marker





Press the **[up/down]** key on the control panel to alternate between up and down image orientation.

Remarks:

- The Orientation marker is green in an active 2D image, and white in a frozen Dual or Quad image.

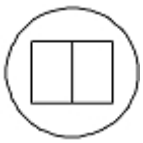
5.2.15 Multi Format

The "Multi Format" controls **[Dual]** and **[Quad]** allows you to display several 2D mode images simultaneously on the screen. The left trackball key and the format keys themselves allow for movement between the images.

There are three 2D mode display formats each one having a different screen layout.

- Single-Screen Format
- Dual-Screen Format 'Dual-Screen Format' *on page 5-9*
- Quad-Screen Format 'Quad-Screen Format' *on page 5-10*

5.2.15.1 Dual-Screen Format



[Dual] Screen Format key (hard key): Press this key to change the display mode from Single or Quad display format to the “Dual”- display format.

Real time mode:

Pressing the Dual mode key freezes the 2D image in the currently active display position and activates the real time 2D image in the opposite display position. Next Position (Dual): 1 > 2 >1 and so on

Freeze mode (read mode):

The Dual mode key selects the next display position without activating real time mode thus allowing for post processing (read magnifying, cine etc.) of a frozen image. If no image is stored in the next position, then real time mode is activated in the next position.

The right trackball key:



Real time mode:

The [Update 2D] key freezes the real time 2D image in the currently active display position and activates the real time 2D image in next display position.

Freeze mode:

The [Update 2D] key activates the next display position in real time mode.

The upper trackball key:



The upper trackball key changes between Cine and 2D image position of the frozen 2D image.

Freeze key:



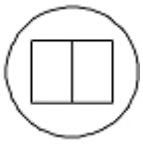
Real time mode:

The **[Freeze]** key freezes the real time 2D image in the actual display position.

Freeze mode:

The **[Freeze]** key activates real time mode of the frozen 2D image in the actual display position. The last real time settings will be employed again in the new selected display position.

Operation:



1. Select Dual display mode.

Please note: At the time being the horizontal format is not yet implemented.

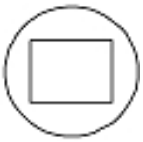
2. Freeze the image.

3. Select the next display position by using the format key.

4. Freeze the next image.

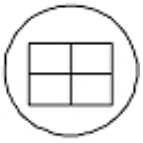
If the image is frozen and you use [Update 2D] (the right trackball key) the opposite display position is activated.

If the image is active (in real time mode) by pressing the [Update 2D] (the right trackball key) the next image is selected and active.



Press the **[Single]** key to return to Single display mode.

5.2.15.2 Quad-Screen Format



[Quad] Screen Format key (hard key):

Press this key to change from Single or Dual display format to "Quad" format.

real time mode (write mode):

The Quad mode key freezes the real time 2D image in the actual display position and shows the real time 2D image live in the next display position. Next Position (Quad): 1 > 2 >3>4>1 and so on

Freeze mode (read mode):

The Quad mode key selects the next display position without activating the real time mode to allow for post processing (read magnifying, cine etc.) of a frozen image. If no image is stored in the next position, then the real time mode is activated in the next position.

The right trackball key:



real time mode:

The [Update 2D] key freezes the currently active 2D image and activates the real time 2D image in the next display position.

Freeze mode:

The [Update 2D] key activates the real time 2D image in the next display position.

The upper trackball key:



Freeze mode:

The upper trackball key changes between Cine and 2D image position of the actual 2D image.

Freeze key:



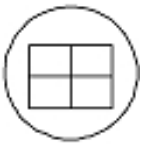
real time mode:

The **[Freeze]** key freezes the real time 2D image in the actual display position.

Freeze mode:

The **[Freeze]** key activates real time mode of the frozen 2D image in the actual display position. The last real time settings will be employed again in the new selected display position.

Operation:



1. Select Quad display mode.

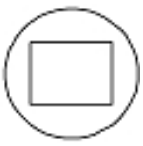
2. Freeze the image.

3. Select the next display position by using the format key.

4. Freeze the next image.

If the image is frozen and you use [Update 2D] (the right trackball key) the next image is selected and active.

If the image is active (in real time mode) by pressing the [Update 2D] (the right track ball key) the next image is selected and active.



Press the **[Single]** key to return to Single display mode.

5.2.16 Cine Mode

While scanning a certain number of frames (2D images of the last examination sequence) will be stored in the cine memory upon **[Freeze]**. The sequence can be reviewed image by image.



Move the trackball horizontally to display the 2D images of the stored sequence, one by one.

The last stored sequence consists of images from the last scan procedure and will be stored until the next scan procedure by **[Freeze]**.

Display: "**Cine: xxx**" in the monitor's status area.

Review:

- 'Cine-Split Function' *on page 5-12*
- '2D Auto Cine' *on page 5-12*

Remarks :

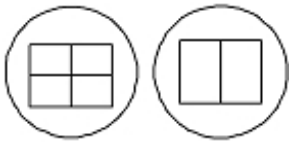
- The number of stored images depends on the number of scan lines, scan depth and magnification. In read mode the length of the sequence is indicated on the monitor. Display: Cine xxx
- Starting the Cine mode erases measuring marks and measuring displays.
- The Cine Function (operation and storage) is identical in 2D mode and CFM mode.

5.2.16.1 Cine-Split Function

When in Dual or Quad-screen mode, either side or quadrant has a cine sequence associated with it.



Move the trackball horizontally to display the 2D images of the stored sequence.



Using the **[Format]** keys you can change to the next frozen 2D image sequence to play back the cine memory.

Remarks :

- In Dual image mode 2D cine each image takes half of the memory as in Single mode.
- In Quad image mode 2D cine each image takes only one quarter of the memory.
- The Cine-Split function (multiple format) is also possible with 2D Auto Cine.

5.2.16.2 2D Auto Cine

With the "2D Auto Cine" function the user can review a defined sequence (start, end) of Single-, Dual- and Quad format 2D- and 2D/Color images. Review speed and read-zoom are available.

1. Store a 2D image or a CFM image.

Note *In dual- and quad formats select the desired image using the [Format] keys.*



2. Press the left trackball key [Auto Cine]. The 2D Auto Cine menu appears on the screen.



3. Select the review speed. 100% corresponds to the recorded speed (real time).



4. Select the read-zoom by pressing [+] or [-] on the Menu control (factor 0.8 to 2.4) .



5. Select the Cineloop mode review direction.

Images are displayed from Start to End and back.

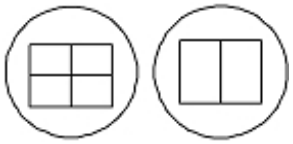
Images are only displayed from Start to End.



8. Start/Stop the 2D Auto Cine function with the right or left trackball key. At dual- and quad formats only the Cine sequence of the active 2D image (indicated with the green dot) is displayed.

Remarks:

- The 2D Auto Cine function is only possible in read mode.
- The 2D Auto Cine function is also possible at multiple formats.



In Dual or Quad screen format select the desired image prior to pressing [Auto Cine]. To change to the next side or quadrant press the **[Exit]** key, choose the image using the format key, activate [Auto Cine] and then [Start] to play back the cine memory of the active 2D image (indicated with the green dot).

- If the 2D Auto Cine function is stopped, move the trackball horizontally to display the 2D images of the stored sequence one by one.
- Press the **[Exit]** key on the control panel to return to the 2D Main mode menu.

5.2.17 Read Zoom

The image can be magnified in read- and write mode with the Zoom function.



Use the [Zoom] control to adjust the zoom factor. Nine positions are possible: from factor 0.8 to factor 2.4

By pressing on the control automatically the factor 1.0 is set. It is also possible if High Resolution Zoom (PanZoom or HDZoom) is active, but it has no influence on the area, which is selected in the Overview image.

Remark:

- The Zoom function is possible in read- and write mode.

5.2.18 PanZoom and HDZoom



The 2D image can be magnified in write mode. The displayed zoom box can be placed over the entire 2D image area; also the size of the zoom box can be changed. The scan frame rate and line number are automatically optimized with the zoom box active in write mode.

1. Press the **[Zoom]** key.

2. Place the zoom box over the region of interest.



The trackball has two functions: adjusting position and size of the zoom box. The activated function is displayed in the status bar area on the monitor.

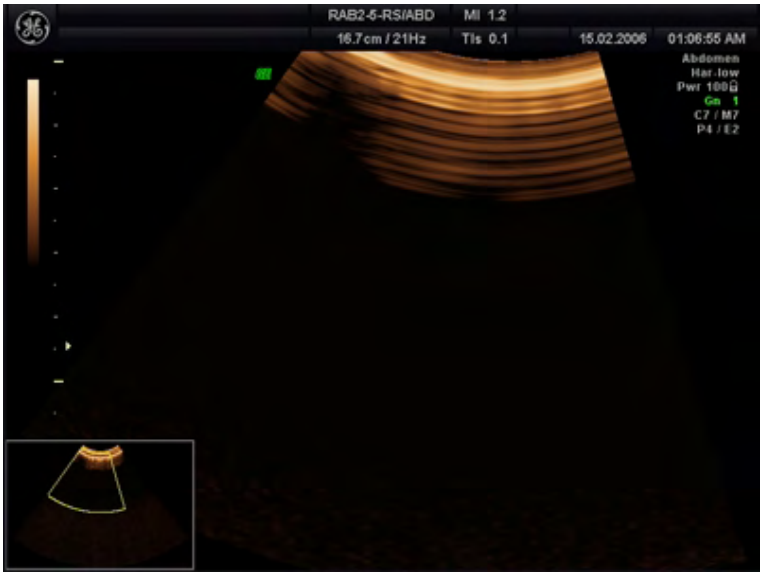


Press the upper trackball key to change the function of the trackball from position to size or vice versa.

3. Change the size of the zoom box by moving the trackball.

Moving:

↑ decrease the box size in vertical direction ↓ increase the box size in vertical direction
→ increase the box size in horizontal direction ← decrease the box size in horizontal direction





Press the **right or left trackball key** to manually pick the desired Zoom mode. PanZoom and HDZoom are available.



Alternatively, press the **Zoom** button to again to enter the default Zoom mode. Specify the default mode in the system setup. See 'General' *on page 16-4* for further information.



To switch between PanZoom and HDZoom during active acquisition press the **left trackball key**.

To readjust overview window settings, see 'User Settings' *on page 16-8*.

Remarks:

- In the overview image the zoom box is depicted with a yellow border and is identical with the zoomed sector on screen. Using read zoom has not effect whatsoever on the zoom box in the overview image.
- The overview window is in Full Screen, Quad Screen and Dual Screen in following modes available: B-Mode, CFM mode and PD mode.
- The overview window is not displayed in following modes:

PW mode, M-Mode and 3D/4D Mode.

If one of these modes is activated, the overview window is hidden.

If the mode is deactivated again, the overview window appears again.

Note *All adjustments (Zoom on/off, Overview Image size and position, Zoom Box pos/size, etc.) are only applied to the currently active screen (green GE Logo) and to all new screens (updated after adjustment).*

Note *In Power Doppler and Color Doppler mode the box size and the box position of Zoom box is the same as the Color box size +10% . When the box size or box position is changed, the Color box and zoom box are adjusted so that above relation remains constant.*

Note *The Zoom box is linked with the color box (changes caused by steering such as steering angle or box size cause the same changes in the zoom box.)*

Note *Color is only visible in the overview window if it was turned on before HD Zoom was activated. Color does not move in the overview image.*

Note *Gray/Chroma adjustment also affects Overview Image*



Press the **[Zoom]** key to exit the Zoom function.

5.3 XTD-View

XTD-View is an option. If it is not installed, the XTD-View button is hidden.

XTD-View provides the ability to create and view a static 2D image which is wider than the field of view of a given transducer. This feature allows viewing and measuring of anatomy which would not fit on a normal ultrasound image.

XTD-View creates an extended image from individual image frames as the operator slides the transducer along the surface of the skin. The probe is oriented parallel to the direction of motion throughout the scan. The quality of the resulting image is somewhat user-dependent. It requires some additional skills and practice to develop a proper technique and become fully proficient.

Examples include scanning of vascular structures and connective tissue in the arms and legs.

5.3.1 XTD-View Main Menu



By pressing the XTD Button, the system switches to XTD-View preparation mode. A blue frame is displayed around the 2D image.



In the Main Menu you can select between centered or moving Acquisition Display.



The current 2D scan is placed in the middle of the screen. The resultant XTD-image scrolls to the left or right of the screen, depending on the transducer orientation.



The acquired 2D image moves until it reaches the edge of the screen. Further scanning causes the acquired image to scroll in the opposite direction.

You can also activate SRI (Speckle Reduced Imaging). For further details see 'Speckle Reduction Imaging (SRI II)' *on page 10-76*.

5.3.2 Starting the Acquisition

The quality and usefulness of XTD-View images is affected by the movement of the transducer. Incorrect technique can contribute to image distortion.

Guidance and precautions for uniform motion:

- Make sure that there is enough coupling gel along the scan path.
- Always move the transducer slowly and steadily. Best results are achieved by moving the transducer with 2cm/s (max. 4cm/s).
- Continuous contact is required throughout the length of the extended image.DO NOT lift the transducer from the skin surface.
- Always keep the transducer perpendicular to the skin surface.DO NOT rock, rotate or tilt the transducer during the scan.
- Keep the motion within the same scan plane, if possible.DO NOT slide the transducer laterally.
- DO NOT change the direction of movement during the scan.e.g.; DO NOT move back- and forward while scanning.
- The system accommodates a reasonable range of motion velocity.DO NOT make abrupt changes in speed of motion.
- Deeper scans generally require reduced acquisition speed.
- Perform a detailed examination of the anatomy/pathology and optimize parameters for tissue texture and visible window PRIOR TO activating XTD-View.



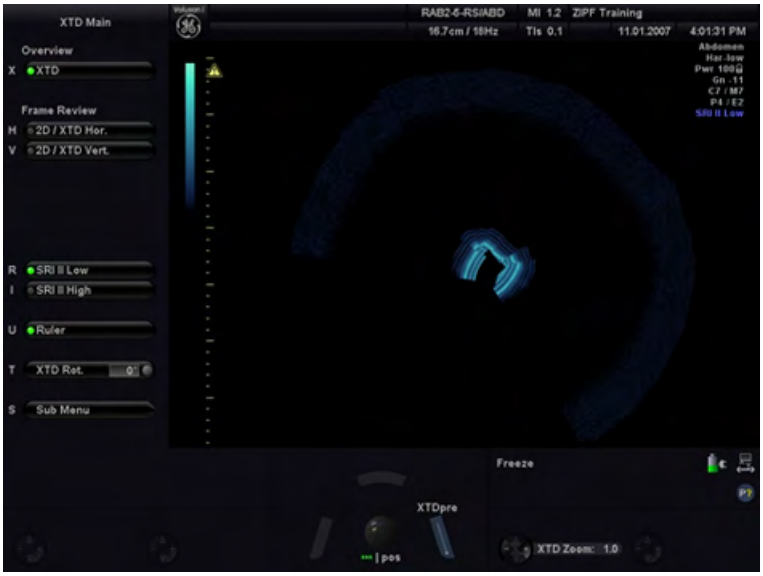
To start acquiring an image, press the right trackball key.

To complete the scan, press the right trackball key again Stop, or press the Freeze key.

After completing the scan, the system displays the acquired XTD-View image.

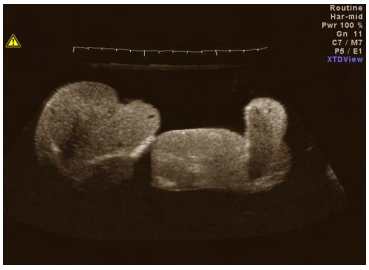
If you want to return to preparation mode and discard the acquired image, press the right trackball key (XTDpre).

5.3.3 After the XTD-View Acquisition



Guidance and precautions for interpreting XTD-images:

- Always adopt a critical attitude to images created in XTD-mode.
- Be aware that any diagnostic conclusion must not be drawn from XTD-images alone, but has to be checked with other diagnostic procedures.
- If in doubt about a structure seen in XTD-View mode, consult the original 2D-slides in the Frame Review ('Functions after the Acquisition' *on page 5-20*).
- Please note that the accuracy of measurements in XTD-images is limited and can be lower than measurements in B-images.



A good XTD image has a smooth edge, with no sharp curves. It has a clear direction, with almost no curves. When reviewed with the corresponding 2D-images, the cursor moves linearly over the XTD-image, e.g. equal trackball distances lead to an equal movement of the blue rectangle. All structures visible in the 2D-images can be found clearly in the XTD-image.



A poor quality XTD image can easily be identified by its rough and curved edge. Further, there are sections that look like noise next to sections of clear structures. If the transducer was tilted during the scan, or the scanning plane was lost, the image gets curved, even if the transducer was moved straight. When reviewed with the corresponding 2D-images, there will be regions where the blue rectangle seems to be stuck in the XTD-image. In such areas, structures that can be seen clearly in the 2D-images are very distorted or not shown at all in the XTD-view.

If any of the above descriptions of a poor XTD-image apply, the scan has to be repeated and the acquired image considered as worthless.

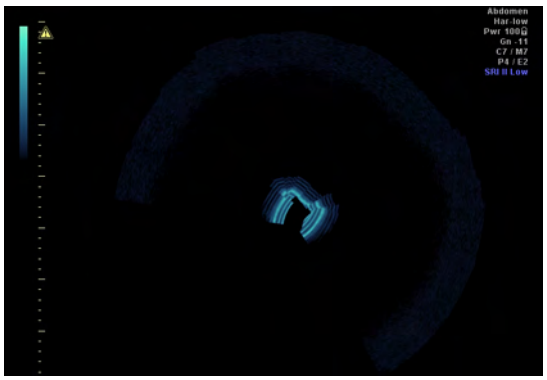
5.3.4 Functions after the Acquisition

- 'Frame Review' *on page 5-20*
- 'Ruler' *on page 5-22*
- 'XTD Rotation' *on page 5-22*
- 'XTD Zoom' *on page 5-22*

5.3.4.1 Overview

The default display format for XTD-View images.





5.3.4.2 Frame Review

Two “Split-screen” display formats are available for reviewing the acquired frames



Horizontal image display





Vertical image display

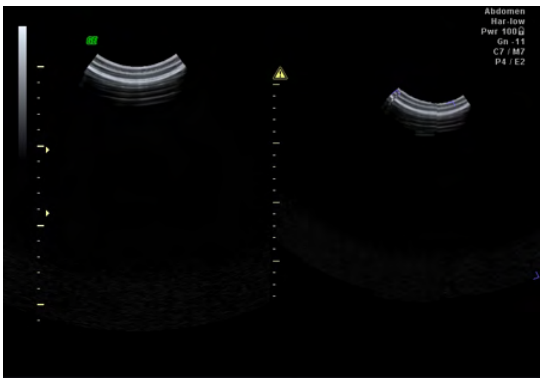


Image Sizes in Frame Review



Fit:The XTD-image fits the border of the screen, which is the default setting.



Over Scan: XTD-image fits to an imaginary border (20% bigger than screen)The blue border of the 2D image is displayed again for orientation.It indicates the position of the 2D image in the Over Scan XTD-image.

Remarks:

- The blue border of the 2D image is displayed for orientation.It indicates the position of the 2D image in the XTD-image.
- The blue borders do not change when 2D image is zoomed.



The trackball has two functions in Frame Review: Frame and Position (pos) (Frame moves the blue box in the XTD-image and Position will move the B-image itself. The activated function is displayed in the status bar area on the monitor.



To change the current function, press the upper trackball key.

5.3.4.3 SRI

There are two levels of SRI availabe: Low and High. You can also turn SRI off. For further information see 'Speckle Reduction Imaging (SRI II)' *on page 10-76*.

5.3.4.4 Ruler



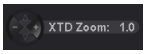
By default, a ruler is displayed. It can be turned off/on by pressing the Ruler button.

5.3.4.5 XTD Rotation



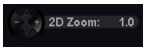
Press the XTD Rot. button in order to rotate the XTD-View image by means of the trackball.

5.3.4.6 XTD Zoom



Change the zoom level of the XTD-View image by means of the +/- menu soft buttons. The XTD-Zoom control is only available in Overview display mode.

5.3.4.7 2D Zoom



Change the zoom level of the 2D image by means of the +/- menu soft buttons. The 2D-Zoom control is only available in Frame Review display mode.

5.3.5 Measurements in XTD-Image



If the measurement function is activated in mode XTD-View, the yellow caution symbol  appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.

For more information see 'Accuracy of measurements' *on page 12-20.*

This symbol will also be shown on the patient report (in the report header), if the performed XTD-View measurements are stored in the report. *For more information see* 'Basic Patient Worksheet Functions' *on page 13-5.*

Situations that could lead to problems during measurements:

- Pulsing object
- Deformation of the object during scanning
- Long images, long scanning distance (= error propagation with increasing the number of images)
- Out of plane scanning (curved track)

5.4 2D Sub Menu

The Main 2D mode must be active.



Select the [Sub Menu] item.



The functions of the 2D Submenu are shown in the menu area as well as in the status area.

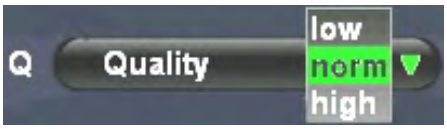
Note *Changes are only possible in write mode! Only changes in the Gray Chroma Map are also possible in read mode.*

The following functions are available:

- 'Quality' *on page 5-23*
- 'Line Filter' *on page 5-24*
- 'Enhance' *on page 5-24*
- 'Dynamic Contrast' *on page 5-24*
- 'Persistence Filter' *on page 5-24*
- 'Reject' *on page 5-25*
- ' Gray Chroma Map' *on page 11-2*
- 'Focus and Frequency Composite (FFC) ' *on page 5-25*

5.4.1 Quality

The “Quality” setting allows the user to make a trade-off between image resolution and frame rate.



There are three steps for Quality:

high: higher resolution / lower frame rate

norm: normal resolution /medium frame rate

low: lower resolution / higher frame rate

5.4.2 Line Filter



The “Line Filter” smoothes the image in the direction parallel to the probe surface (or in a curve). How much filtering is used can be adjusted by the user, more filtering reduces noise at the expense of detail in the image.

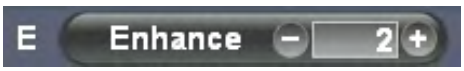


To increase or decrease use the Trackballbuttons.

5.4.3 Enhance

With the “Enhance” function the echo information is digitally processed such that certain existing information becomes easily visible for the eye (e.g., adjacent media layers). Due to the Enhance function a finer, sharper impression of the image is produced.

The Enhance state is displayed in the Image Info area on the screen.





To increase or decrease use the Trackballbuttons.

5.4.4 Dynamic Contrast

“Dynamic Contrast” allows you to enhance a part of the gray scale to make it easier to display pathology. You can select between twelve different Dynamic contrast curves.





To increase or decrease use the Trackballbuttons.

The dynamic contrast is displayed in the Image Info area on the screen.

Dynamic Contrast: C1 to C12

Remark: The appearance of the gray values depends also on the selected gray map. ' Gray Chroma Map' *on page 11-2 .*

5.4.5 Persistence Filter

“Persistence” is a frame averaging function allowing to eliminate image speckle from 2D images. With higher persistence setting more frames are averaged. Persistence can be set in the 2D Sub menu in write mode.





To increase or decrease use the Trackballbuttons.

5.4.6 Reject

Low echo information will not be displayed on the screen below the adjusted reject level. The [Reject] function determines the amplitude level below which echoes are suppressed (rejected). Reject set to high leads to bad tissue display. (e.g., Use Reject to eliminate artifacts within vessels.)





Change the range by moving the trackball.

Reject range max.: 255 Reject range min.: 0 step size: 5

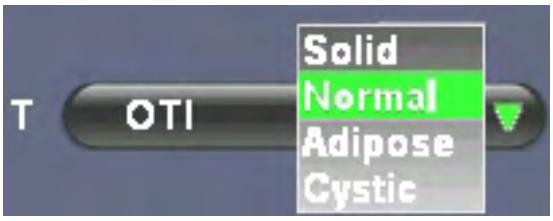
5.4.7 Optimized Tissue Imaging (OTI)

The function OTI™ allows the examiner to “fine tune” the system for scanning different types of tissue.

Use the [OTI] button to adjust the respective parameter. Four positions are possible: adipose, solid, cystic or normal tissue.

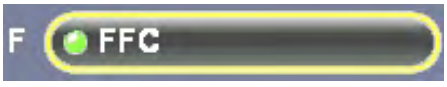
Remark:

- Setting the relevant parameter improves image quality.



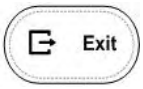
5.4.8 Focus and Frequency Composite (FFC)

The Focus and Frequency Composite (FFC) technology utilizes two different transmit frequencies and two different focal ranges in the 2D image. This function combines a low frequency to increase the penetration and higher frequency to keep a high resolution. It reduces speckle and artifacts in the 2D image to facilitate the examination of difficult-to-scan patients.



Switch on /off the [FFC] Focus and Frequency Composite function in 2D mode.

5.4.9 Exit the 2D Sub menu



Press the **[Exit]** key on the control panel to exit the 2D Sub menu.

Chapter 6

M Mode

Describes the Motion mode and its features.

M Mode

M mode imaging provides Time and Motion echo information derived from a stationary ultrasound beam. M mode is used along with a 2D image. A straight line running through the 2D image, called the M-cursor, identifies the position of the stationary ultrasound beam from which the echo information is being gathered. The motion or change that occurs at this position over time is used by the system to generate the scrolling M mode display.

M mode is primarily a cardiology mode. M mode records moving anatomical structures and produces subtle patterns of motion. These patterns allow you to plot temporal relationship between events in the cardiac cycle. Precise measurements of structures are possible with M mode. M mode also provides textural information that permits discriminating between normal and abnormal tissue.

The M mode display contains system information, a depth scale, a time scale, a TGC curve, and a gray map pattern. There are three M mode display format options; 'Format' *on page 6-6*

The continuous update of the M mode display allows you immediately to recognize changes in anatomical position relative to the M-cursor. With this instant information you can immediately aim the M-line to the structures of interest by adjusting the probe.

The description of M mode is subdivided in two groups. In these groups you will see how to use M mode and how to adjust the M mode settings.

To use the M mode review: 'M Main Menu' *on page 6-2*

To adjust M setting review: 'M Sub Menu' *on page 6-6*

M mode is also possible in combination with CFM mode:

For more information see 'MCFM Mode (M Color Flow Mode)' *on page 6-8*.

6.1 M Main Menu



M mode key (hard key)

By pressing the **[M]** control the M mode is switched on in the preparation mode, only the M-cursor appears on the active 2D image.

The “M Main” menu appears on the screen. (write mode)

To start and use the M mode review: 'M Operation' *on page 6-3* .

Remarks:

- In read mode changing the Gain, Speed and Frequency is not possible.

6.1.1 Principle

The M mode display is derived from a 2D image display. When switching on the M mode, the M-cursor line is inserted into the 2D image. It symbolizes the ultrasound beam and defines the position of the M mode trace. The M mode trace is initialized with the right or left trackball key.

Simultaneous mode:

With electronic probes the 2D-and the M trace will be displayed simultaneously. The M mode trace is displayed in scroll mode (the most recent information is always shown at the right part of the trace).

6.2 M Operation

The M operation consists of:

- 'Cursor Position' *on page 6-3*
- 'Activation of M Mode' *on page 6-3*
- 'Sweep Speed' *on page 6-3*
- 'Invert' *on page 6-4*
- 'Frequency' *on page 6-4*
- 'TGC Slide Controls' *on page 6-4*
- 'Transmit Power' *on page 6-4*
- 'M Mode Depth' *on page 6-5*
- 'M Gain Control' *on page 6-5*
- 'M Cineloop' *on page 6-5*

6.2.1 Cursor Position



After pressing the **[M]** control adjust the M-cursor using the trackball in the 2D single image.

6.2.2 Activation of M Mode



Press the right or left trackball key and 2D mode and M mode trace are active.
The screen is divided asymmetrically. In the image above the 2D image appears. In the image below the M mode trace starts running.

Three display formats are possible. *For more information see* 'Format' *on page 6-6.*



The **[Freeze]** key stops the 2D image and M mode trace. By pressing the **[Freeze]** key again, the M-cursor appears on the active 2D image.

6.2.3 Sweep Speed

On the status area you will find the [Speed] key. By touching up or down four different sweep speeds can be selected. Use the [+] and the [-] Menu control to increase or decrease the speed.



1 = 3.5 cm/s

2 = 5.0 cm/s

3 = 7.5 cm/s

4 = 10.0 cm/s (in relation to the system's monitor)

6.2.4 Invert

This function inverts the M mode trace from Up to Down in the M mode display area.



key unlit : M mode display normal

key lit: M mode display inverted

Remark: The Invert function is only available with endo-vaginal probes.

6.2.5 Frequency



It is the same as the 2D mode frequency.

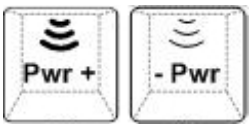
For more information see 'Receiver Frequency Range' *on page 5-7.*

6.2.6 TGC Slide Controls

The [TGC]- settings is the same for the M trace and the 2D image.

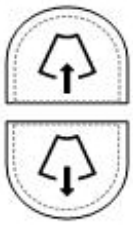
For more information see 'TGC Slider Controls' *on page 5-4.*

6.2.7 Transmit Power



This function is the same for the M trace and the 2D image. *For more information see* 'Transmit Power' *on page 5-5.*

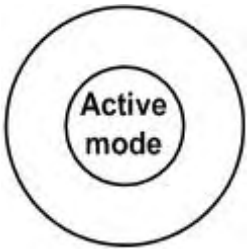
6.2.8 M Mode Depth



The function is the same as 2D mode depth. *For more information see* '2D Mode Depth' *on page 5-3*.

6.2.9 M Gain Control

With the [Active mode] control the overall brightness of the M mode trace can be adjusted. The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth. The M Gain function influences the M trace only.



[Active mode] key:rotate it to adjust the sensitivity (brightness) of the entire image.

When the GAIN control is turned clockwise the entire image gets brighter. When the GAIN control is turned counterclockwise the entire image gets less bright.

Remarks:

- GAIN range: -15dB to 15dB. The actual gain value is displayed on the screen [GN ...]
- Changing the M Gain is only possible with active M mode (write mode).

6.2.10 M Cineloop

Several 2D image frames and M mode trace information can be recalled. When freezing, a certain time frame (M information of the last examination sequence) is stored in a loop memory. The sequence can be reviewed second by second.

Display:

Cine for 2D imagesor **Loop** for M trace on the monitor (status bar) min length: 60 seconds

Operation:

1. Freeze the image.

After freezing, the trackball is active for the M mode trace loop / 2D cine.



2. The upper trackball key changes from the M loop to the 2D cine, and back. The active cine is displayed on the monitor:
Cine/**Loop xxx** or **Cine xxx/**Loop



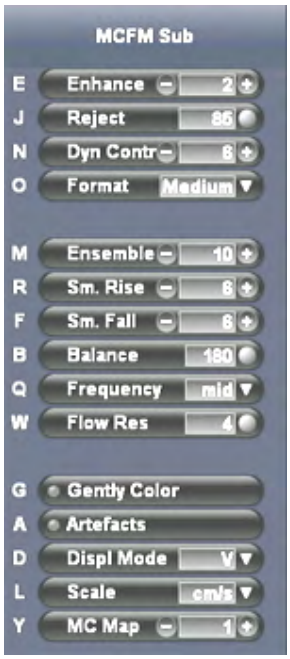
3. Use the trackball to recall the stored sequence by moving it horizontally.

6.3 M Sub Menu

The “M Main” menu must be active.



Select the [Sub Menu] item.



The functions of the M Submenu are shown in the menu area as well as in the status area.

Note *Changes are only possible in write mode.*

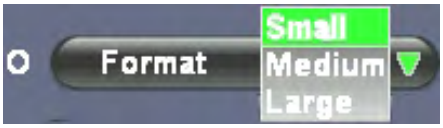
Note *Only changes in the Gray Chroma Map are possible in read mode.*

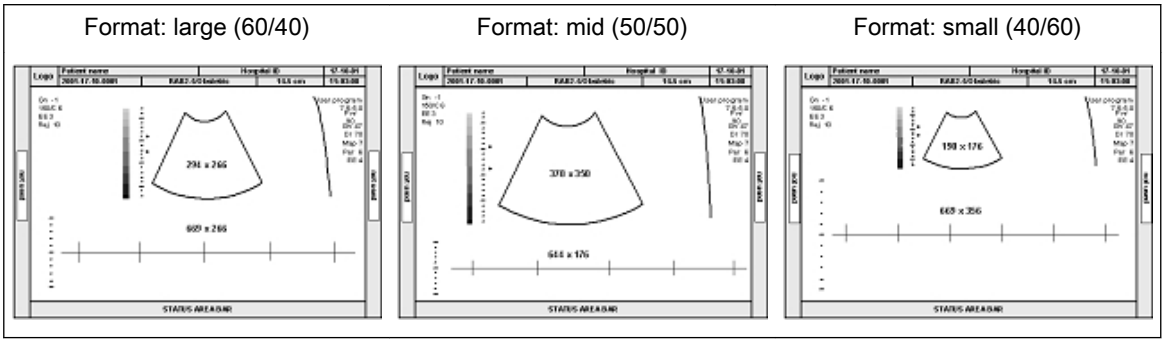
The following functions are available:

- 'Format' *on page 6-6*
- 'Enhance' *on page 6-7*
- 'Dynamic Contrast' *on page 6-7*
- 'Reject' *on page 6-8*

6.3.1 Format

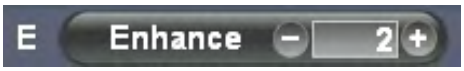
For selection of three different ratios of display Format (60/40 , 50/50 and 40/60).





6.3.2 Enhance

With the “Enhance” function the echo information is digitally processed such that certain existing information becomes easily visible (e.g., adjacent media layers). Due to the Enhance function a finer, sharper impression of the image is produced.



The Enhance state is displayed in the Image Info area on the screen.



To increase or decrease use the Trackballbuttons.

6.3.3 Dynamic Contrast

“Dynamic Contrast” allows you to enhance a part of interest of the gray scale to make it easier to display pathology. You can select between twelve different dynamic contrast curves.



The dynamic contrast is displayed in the Image Info area on the screen. Dynamic Contrast: C1 to C12

To increase or decrease use the Trackballbuttons:



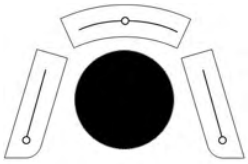
Remarks:

- The appearance of the gray values depends also on the selected gray map. *For more information see* ' Gray Chroma Map' *on page 11-2.*

6.3.4 Reject

The “Reject” function determines the amplitude threshold above which the ultrasound echoes are displayed on the screen (suppression of smaller echoes). Display (control range) 0 to 255. The Reject state is displayed in the Image Info area on the screen.





To change the value scoll with the trackball:

Reject range max.: 255

Reject range min.: 0

step size: 5

6.3.5 Exit the M Submenu



Press the **[Exit]** key on the control panel to exit the M Submenu.

6.4 MCFM Mode (M Color Flow Mode)

Color Flow Mode and Color M Mode are Doppler modes intended to add color-coded qualitative information concerning the relative velocity and direction of fluid motion within the 2D mode or M mode image. Color Flow overlays color on the M mode trace using velocity and variance color maps. The Color Flow wedge overlays the 2D mode image and M mode timeline.

The description of MCFM mode is subdivided in two groups:

To use the MCFM mode review: 'MCFM Main Menu' *on page 6-8*

To adjust MCFM setting review: 'MCFM Sub Menu' *on page 6-12*

6.4.1 MCFM Main Menu

[M Mode] key + **[CFM Mode]** key (hard keys)

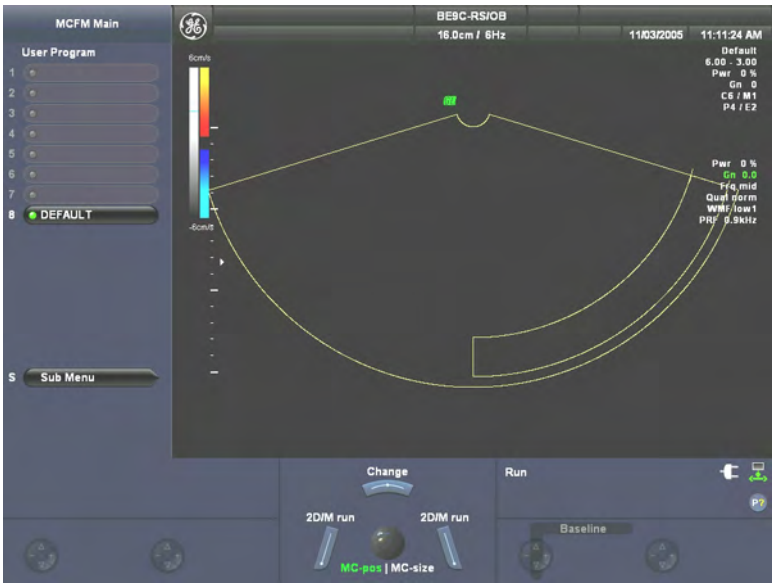


By pressing the **[M]** control and the **[CFM]** control, the MCFM mode is switched on in the preparation mode. The M-cursor with M-Color window appears on the active 2D image. These hard keys are also the Gain control for the MCFM mode (only in write mode); 'M Gain Control' *on page 6-5*



To start and use the MCFM mode review: 'MCFM Operation' *on page 6-9* . To adjust the MCFM settings review: 'MCFM Sub Menu' *on page 6-12*.

The “MCFM Main” menu appears on the screen (write mode).



Remarks:

- In read mode changing the Speed, Wall Motion Filter, PRF and Gain is not possible.
- In MCFM mode only one focus zone is available.
- When the MCFM-box is moved, the focus position is set to the middle of the Color box.

6.4.2 MCFM Operation

The MCFM operation consists of:

- Color Box Size and Cursor Position
- Activation of MCFM Mode
- MCFM Gain Control
- Invert
- Wall Motion Filter (WMF)
- Velocity Range (PRF)
- MCFM Cineloop

All further image-optimizing functions are the same than those of the M mode. For details review: 'M Operation' *on page 6-3*

6.4.2.1 Color Box Size and Cursor Position



After pressing the **[M]** and the **[C]** control adjust the Color box size and the cursor position using the trackball in the 2D single image.



The upper trackball key changes between cursor position and Color box size and vice versa.

6.4.2.2 Activation of MCFM Mode



Press the right or left trackball key and 2D mode and MCFM mode trace are active.

The screen is divided asymmetrically. In the image above the 2D image appears. In the image below the MCFM mode trace starts running.

Three display formats are possible, review: 'Format' *on page 6-6*

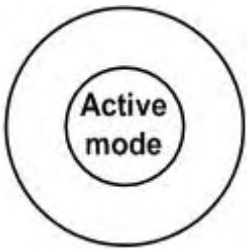


The **[Freeze]** key stops the 2D image and MCFM mode trace.

Note *By pressing the **[Freeze]** key again, the MCFM-cursor appears on the active 2D image.*

6.4.2.3 MCFM Gain Control

The adjustment of the Gain control determines the amount of amplification applied to the received echoes. All received echoes are amplified with the same gain value regardless of the scan depth.



To increase or decrease the gain, rotate the [Active mode] wheel. To change between the modes press the [Active mode] key.

Note *The **[M]** Gain function influences the M trace sensitivity only.*

Note *The **[CFM]** Gain function influences the color intense only.*

Remarks:

- The actual gain value is displayed on the screen [GN ...].

6.4.2.4 Invert



This function inverts the color display in the MCFM mode image. The color of the color wedge inverts around the baseline.

MCFM color display normal	↑ red ↓ blue
MCFM color display inverted	↑ blue ↓ red

6.4.2.5 Wall Motion Filter (WMF)

A Wall Motion Filter is used to eliminate Color “noise” that is caused by vessel wall or cardiac wall motion and that is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of the walls of vessels or the heart, but that is sensitive enough to retain grayscale spectral information near the base line. The WMF control is used to change the wall motion filter. The settings are: low1, low2, mid1, mid2, high1, high2 and max.



Use the [WMF] Menu control to adjust the required Wall Motion Filter. Press up increases the filter; press down decreases the filter.

Remarks:

- The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher PRF setting and vice versa.
- The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

6.4.2.6 Velocity Range (PRF)

The Velocity range of the display is governed by the pulse repetition frequency (PRF). The [PRF] control changes the display range. As you increase the Velocity range by that control, the PRF increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing also increases.



Use the [PRF] Menu control to adjust the velocity range. Press up - the PRF increases; press down - the PRF decreases

Depending on the Box depth the maximum sampling frequency will be automatically reduced. (If the sampling frequency is no more suitable for the selected depth.)

Changing the PRF display unit from kHz to m/s or cm/s; review 'MCFM Sub Menu' *on page 6-12*

Note *The current sampling frequency is displayed on the screen [PRF ...].*

6.4.2.7 MCFM Cineloop

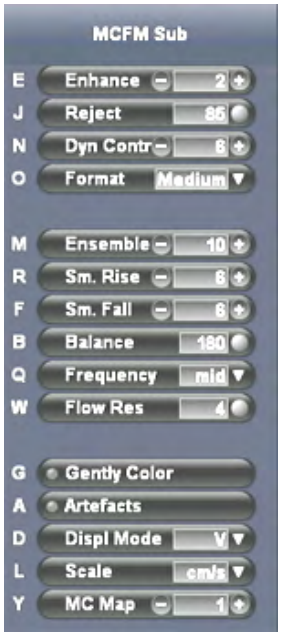
For more information see 'M Cineloop' *on page 6-5.*

6.4.3 MCFM Sub Menu

The “MCFM Main” menu has to be active.



Select the [Sub Menu] item.



The functions of the MCFM Submenu are shown in the menu area as well as in the status area.

Note *Changes are only possible in write mode!*

Note *Changes in the Display Mode, Scale, MCFM Map and Baseline are also possible in read mode.*

The submenu settings are the same than those of the CFM mode. *For more information see* 'CFM Sub Menu' *on page 8-6.*

Chapter 7

PW Mode

Describes the Pulsed Wave Mode and its features

PW Mode

Doppler imaging includes a spectral analysis which describes the Doppler shift signal from the moving reflectors within a sample volume. The spectral display scrolls from right to left and depicts the spectral distribution of the components of the Doppler shift frequency over time. Frequency or velocity values appear on the vertical axis and time along the horizontal axis. Component amplitudes appear as shades of gray. The brighter the shade, the higher the amplitude.

The Doppler display can be used alone, but it is normally used with a 2D image. The 2D image contains a Doppler cursor that defines the location of the Doppler ultrasound beam relative to the 2D image display.

The flow direction cursor can be aligned with the direction of flow within the vessel to determine the Doppler angle. The system uses the Doppler angle to calibrate the Doppler velocity display. When the Doppler frequency display is used, the frequency display is not calibrated to account for the Doppler angle.

The Doppler display consists of the following: the spectral analysis display of the ultrasound data, patient data and identification, image information, a gray scale map, a velocity or frequency scale, and a time scale.

The TI and MI values on the monitor depend on the values set by the Doppler controls. Please refer to *Chapter 2* and *Chapter 18* for a complete explanation of the acoustic output.

7.1 PW Mode (Pulsed Wave Doppler)

A sample volume cursor is located on the PW cursor and it indicates where, along the ultrasound beam, the spectral analysis is being performed. A flow direction cursor can be added to the sample volume.

The PW mode is subdivided in two groups. In these groups you will see how to use PW mode and how to adjust the PW settings.

To use the PW mode review: 'PW Main Menu' *on page 7-2*.

To adjust PW setting review: 'PW Sub Menu' *on page 7-9*.

7.2 PW Main Menu

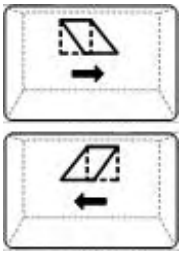


PW Mode key (hard key)

Press the **[PW]** control to activate the PW mode in the preparation mode. First only the PW-cursor appears on the active 2D image.

To start and use the PW mode review: 'PW Operation' *on page 7-3*. To adjust the PW settings review: 'PW Sub Menu' *on page 7-9*.

The “PW Main” menu appears on the screen (write mode).



Remarks:

- Changing the Gain, Speed, Gate width, Loudspeaker Volume, Wall Motion Filter and PRF is not possible in read mode.
- The Steering function is only possible with linear probes.

7.3 PW Operation

The PW Operation includes:

- 'Gate Position and Gate Width' *on page 7-3*
- 'Activation of PW Mode' *on page 7-4*
- 'PW Gain Control' *on page 7-4*
- ' PW Automatic Optimization' *on page 7-5*
- 'Sweep Speed' *on page 7-5*
- 'Invert' *on page 7-6*
- 'Angle Correction' *on page 7-6*
- 'Baseline' *on page 7-6*
- 'WMF' *on page 7-7*
- 'Velocity Range (PRF)' *on page 7-7*
- 'Real Time Trace' *on page 7-8*
- 'Freeze' *on page 7-8*
- 'PW Cineloop' *on page 7-9*

7.3.1 Gate Position and Gate Width

In Pulsed Wave Doppler, a specific area along the ultrasound beam is sampled. This area is called the gate. The gate is located on the ultrasound beam and is displayed by two lines perpendicular to the beam line. You can change the location and size of the gate. The location and the angle of the gate can be changed by trackball (press the upper trackball key to change the function of the trackball). Location of the gate allows examination of the blood flow at this site. The width of the gate can be changed by Menu Control key. When changing the gate size, in update or simultaneous mode, the current value of it is displayed in millimeters on the left side of the display in the image info.



Adjust the PW cursor and Gate Position with the trackball on the 2D single image.

←→ PW cursor position

↑↓ Depth of gate position

The gate size can be adjusted in twelve steps: 0.7mm, 1mm, 2mm, 3mm, 4mm, 5mm, 6mm, 7mm, 8mm, 9mm, 10mm and 15 mm.



The upper trackball key switches between gate position and gate angle. Press the upper trackball key to change from Gate position to gate angle. Press it once more to return to the position change.



↑ decrease the gate size

↓ increase the gate size

7.3.2 Activation of PW Mode

By pressing the left or right trackball key the screen is divided asymmetrically. The 2D image appears above. The PW spectrum appears below. Three display formats are possible. *For more information see* 'Format' *on page 7-10.*

The status area shows the PW mode activation controls.



Press the left trackball key to start the spectral display. The 2D image will be frozen. Press the left trackball key once more; the PW spectrum will be frozen and the 2D image returns to write mode.



Press the right trackball key and both modes (2D image and PW spectrum) are active.

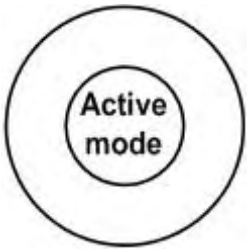
7.3.3 PW Gain Control



PW Gain controls the amplification of the incoming Doppler signals. The Doppler gain should be adjusted to a level that fills in the grayscale of the spectral analysis waveform without creating a noise.

[PW Mode] key

To change the gain of PW mode use the [Active mode] wheel.



When the GAIN control is turned clockwise the entire spectrum gets brighter. When the GAIN control is turned counterclockwise the entire spectrum gets darker.

Remarks:

- The actual gain value is displayed on the screen [GN ...].
- Changing the PW gain is only possible in write mode independent from additional modes such as Color.

7.3.4 PW Automatic Optimization

This function will optimize the following settings: **PRF:** automatic detection of highest flow velocities and adjustment of the velocity scale **Baseline:** will be shifted so that the flow spectrum is centered



Pressing the **[auto]** key enables automatic optimization of the PRF and Baseline.

When the key is pressed again, the optimization will be updated.

Press the **[auto]** key **twice to switch off** the Automatic Optimization in PW mode.

Remarks:

- When the Automatic Optimization function is active, the **[auto]** key is brightly illuminated.
- The PRF and Baseline can always be changed manually!

7.3.5 Sweep Speed

The “Speed” control allows selection of variable sweep speeds. The faster sweep speed may be useful to analyze flow curves. For example, to calculate a mean pressure gradient then it will be much easier to do this on a fast speed trace than on a low speed trace. The [Speed] key is found in the status area; review: 'PW Main Menu' *on page 7-2*

By touching [+] or [-] on the Menu control four different sweep speeds can be selected.



1 = 3.5 cm/s

2 = 5.0 cm/s

3 = 7.5 cm/s

4 = 10.0 cm/s (in relation to the system’s monitor)

7.3.5.1 Audio Signal

The Menu control changes the volume of the audio signal derived from the PW spectrum.



+ both loudspeakers louder

- both loudspeakers lower

The volume is adjustable between 0 and 96 dB.

7.3.6 Invert

This function inverts the PW spectrum display in relation to the direction of the flow. The displayed spectrum is inverted around the baseline. The velocity or frequency scale changes accordingly. Use **[DopInv]** when necessary to change the spectral display orientation. It is possible in both read- and write mode.

Forward flow indicates: Blood flow toward the transducer Reverse flow indicates: Blood flow away from the transducer



key unlit:	Normal:	Forward flow above the baseline Reverse flow below the base line
key lit:	Inverted:	Reverse flow above the baseline Forward flow below the baseline

7.3.7 Angle Correction

To get optimum resolution and accuracy from Doppler measurements, the angle that exists between the ultrasound beam and the blood flow should be maintained between 0 and 20 degrees. However, due to anatomical limitations an angle of 55 to 65 degrees is common in peripheral vascular applications. The blood flow velocity calculation based on the incident angle of the ultrasound beam to the axis of the vessel can be determined this way. The vessel must be displayed in longitudinal section and the angle cursor must be positioned parallel to the vessel axis (in the area of the measuring volume). Angle correction adjusts the Doppler scale and is only necessary for velocity display (cm/s, m/s) according to the Doppler equation.



The cursor angle can be changed in 1º increments in both directions continuously. Use the trackball function keys to switch betweeen Gate position and angle.

Remarks:

- The actual angle is displayed on the screen [SV Angle ...].
- Adjusting the angle is always possible, in write mode and read mode.

7.3.8 Baseline

The PW spectrum baseline shift enlarges the velocity range in one direction. The displayed velocities (cm/s, m/s) or frequencies (kHz) on the upper and lower edge of the screen (scale, white borderline) mark the maximum velocity (maximum measuring range).



The baseline can be shifted up in 8 steps or down in 8 steps by using the up and down key on the Menu control.

Note *Adjusting the baseline is possible in write- and read mode.*

7.3.9 WMF

A “Wall Motion Filter” is used to eliminate Doppler “noise” that is caused by vessel wall or cardiac wall motion and that is low in frequency but high in intensity. Use a wall filter that is high enough to remove the audible thumping of the cardiac walls, but that is sensitive enough to retain grayscale spectral information near the base line. The [WMF] Menu control is used to change the wall motion filter.

The settings are: 70Hz, 120Hz, 155Hz, 190Hz, 230Hz, 300Hz, 500Hz



Use the [WMF] Menu control to select the wall motion filter desired. Press up to increase, press down to decrease the filter.

Remarks:

- The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting. The lowest wall motion filter cutoff frequencies cannot be used with the higher velocity range (PRF) setting. Likewise, the highest wall motion filter cutoff frequencies cannot be used with lower velocity range (PRF) setting.
- The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

7.4 Velocity Range (PRF)

The velocity range on display is governed by the pulse repetition frequency (PRF). The [PRF] control changes the displayed range. As the velocity range is increased by the [PRF] Menu control, the PRF increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing increases, too.



Use the [PRF] Menu control to adjust the velocity range desired. Press up for increasing the PRF, press down to decrease the PRF.

7.5 Real Time Trace

With the “Real Time Auto Trace” function the envelope curve of the Doppler spectrum (maximum velocities) and the corresponding evaluation is automatically displayed on the monitor.

1. Select the [RT Trace] item to display the curve for the maximum velocities (envelope curve) simultaneously with the Doppler spectrum.



unlit: Real Time Trace is switched off. lit: Real Time Trace is switched on.

When starting the Doppler spectrum, the results (according to the “Auto/Manual Trace” setting in the Measure Setup) are displayed and updated every time a new heart cycle is detected. To select the Doppler measuring results review: 'Application Parameters' *on page 17-17 .*



2. Press [Trace] to open the dropdown menu and select the Tracemode.



3. Select the sensitivity of the envelope curve (to eliminate artifacts).

To increase or decrease use the Trackballbuttons:



Important note:

The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

Remark: Activating the Real Time Trace is only possible in write mode. No function in read mode.

7.6 Freeze



The **[Freeze]** key starts and stops the 2D image and PW Doppler. *For more information see* ' To Freeze an Image' *on page 4-6.*

7.7 PW Cineloop

Several 2D image frames and the Doppler spectrum information can be recalled. When freezing the spectrum a certain time frame (D-spectrum of the last examination sequence) is stored in the loop memory. The sequence can be reviewed second by second.

Display:

Cine for 2D imagesor **Loop** for Doppler spectrum on the monitor min length: 60 seconds

Operation:

1. Freeze the spectrum.

After freezing the trackball is active for 2D cine.



2. The upper trackball key changes from the D-loop to the 2D cine, angle and back.

The active Cine is displayed in the trackball graphic on the monitor: Cine/**Loop xxx** or **Cine xxx/** Loop



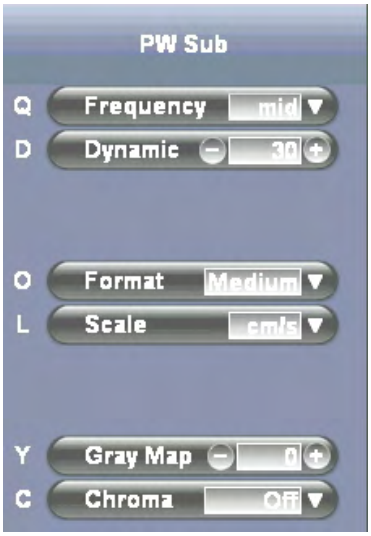
3. Use the trackball to recall the stored sequence by moving it horizontally.

7.8 PW Sub Menu

The “PW Main” menu must to be active.



Select the [Sub Menu] item.



The functions of the PW Submenu are shown in the menu area as well as in the status area.

Note *Changes are only possible in write mode!*

Note *However, changes of the Gray Chroma Map, the angle and the baseline are also possible in read mode.*

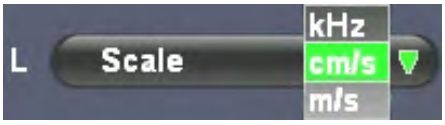
The following functions are available:

- 'Scale' *on page 7-10*
- 'Format' *on page 7-10*
- 'Frequency' *on page 7-10*
- 'Dynamic' *on page 7-11*

7.8.1 Scale

At the upper and lower screen edges the maximum values (in relation to the zero line) and the selected measuring unit are displayed.

e.g.: 97 cm/s (max. displayable velocity) 20/DIV (space between 2 points 20 cm/s)



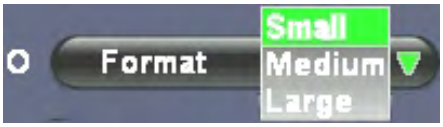
kHz: Doppler shift frequency

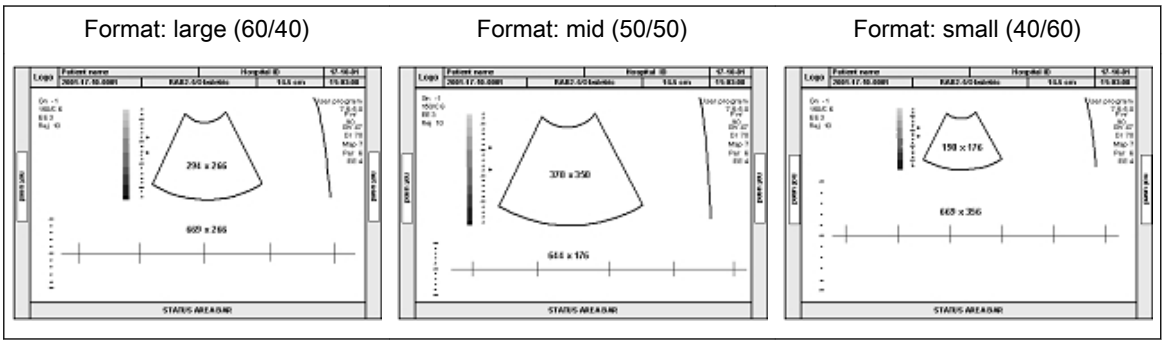
cm/s: flow velocity

m/s: flow velocity

7.8.2 Format

These controls serve for selection of either one of three formats (60/40, 50/ 50 and 40/ 60) for display. Press [Format] to open the dropdown menu and select the Format.



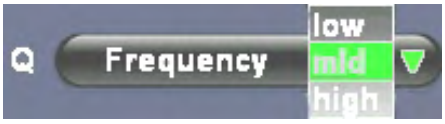


7.8.3 Frequency

This control serves for selection of the required transmit frequency for the actual gate position. Normally one works with the transmit frequency which is corresponding to the ultrasound element's properties [mid]. With a higher transmit frequency [high] the amplitude of the Doppler spectrum is displayed larger (advantage: better display of lower flow velocities), but

the penetration depth is reduced. With a lower transmit frequency [low] the amplitude of the Doppler spectrum is displayed smaller (advantage: display of higher flow velocities), however the penetration depth is increased (higher sensitivity).

The transmit frequency is displayed in the Image Info area on the screen.



low: The transmit frequency is lower than the middle frequency of the crystal.

mid: The transmit frequency is the middle frequency of the crystal.

high: The transmit frequency is higher than the middle frequency of the crystal.

Switch the [Frequency] key to open the dropdown menu and select the desired center frequency desired.

For more information see 'Settings' *on page 18-8.*

7.8.4 Dynamic

Dynamic refers to the compression of grayscale information into a suitable range for the display. Dynamic allows you to enhance a part of interest of the grayscale to make it easier to display pathology. It adjusts the displayed cutoff of the Doppler analysis waveform.



To increase or decrease use the Trackballbuttons:



max. range: 40

min. range: 10

step size: 2

Remarks:

- The appearance of the gray values depends also on the selected Gray Map. To select a PW gray map review: ' Gray Chroma Map' *on page 11-2*.

7.8.5 Exit the PW Submenu



Press the **[Exit]** key on the control panel to exit the PW Submenu.

7.9 PW + 2D + Color Information (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Spectral Doppler and Color Doppler.

There are two possibilities to combine Pulsed Wave Doppler (PW) with Color Information:

- PW + 2D mode + Color Doppler mode (CFM)
- PW + 2D mode + Power Doppler mode (PD)



To start the Triplex mode press the trackball key [Simult].



To start the Dual mode (only 2D+PW) press the trackball key [Update].

Chapter 8

CFM Mode (Color Flow Mode)

Description of the Color Flow Mode and the Triplex Mode.

CFM Mode (Color Flow Mode)

Color Flow Mode is a Doppler Mode intended to add color-coded qualitative information concerning the relative velocity and direction of fluid motion within the B-Mode image. This information is then used to overlay a Color image onto the 2D grayscale image.

Color imaging helps you to locate blood flow disturbances. Color imaging also helps you to locate the sample volume for pulsed-wave Doppler spectral analysis.

Pulsed wave Doppler provides the most accurate peak velocity information when the sound beam axis and flow axis are nearly parallel. This relation between accuracy and angle still exists with Color but it is not as critical as in pulsed wave Doppler. Abnormal flow can still be detected and conclusions drawn with Color flow derived in a near-to-perpendicular situation. Since Color is not specifically designed to detect absolute velocity, it is not as limited by incident angle considerations as pulsed-wave Doppler. The Color mode display incorporates the following with the 2D-display: a Color scale with Color base line, Nyquist limit values, a Wall Motion Filter, a grayscale with a Color echo write balance marker, and annotation of the 2D Color Flow control settings.

The CFM mode is subdivided in two groups. In these groups you will see how to use CFM mode and how to adjust the CFM settings.

To use the CFM mode review: 'CFM Main Menu' *on page 8-2*

8.1 CFM Main Menu

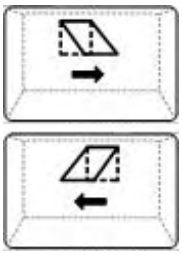


C Mode key (hard key)

Pressing the **[C]** control activates the CFM mode; the CFM box appears in the active 2D image.

To use the CFM mode, review: 'CFM Operation' *on page 8-3*

The “CFM Main” menu appears on the screen (write mode).



Remarks:

- Changing the Quality, Frequency, Wall Motion Filter, PRF, Gain, Invert and 2D+2D/C is only possible in write mode.
- Beam steering is only possible with linear probes and in write mode.

8.2 CFM Operation

The CFM operation consists of:

- 'CFM Box Position and CFM Box Size' *on page 8-3*
- 'CFM Gain Control' *on page 8-3*
- 'Quality' *on page 8-4*
- 'MCFM Operation' *on page 6-9*
- 'PRF (Velocity Range)' *on page 8-5*
- 'Frequency' *on page 8-5*
- 'Invert' *on page 8-5*
- '2D + 2D/C' *on page 8-6*
- 'Threshold' *on page 8-6*

8.2.1 CFM Box Position and CFM Box Size

In 2D imaging the relationship between 2D frame rate, line density, and field-of-view are well known factors to be considered to obtain optimum 2D images. Similar relationships exist in Color imaging. On the CFM Submenu the selection of the line density adjusts the balance between the 2D Line Density and the Color mode line density. The values available are scan head-dependent.

The ability to change the CFM box size and position provides flexibility in CFM imaging. The trackball changes the CFM box size and position.

Adjust the CFM box position on the 2D image with the trackball (in Single, Dual, or Quad mode).



←→ CFM box horizontal position
↑↓ CFM box vertical position
The box is adjustable within the entire 2D image area.



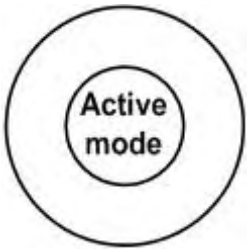
Press the upper trackball key to change from CFM Box position to CFM Box size.
Press it once more and it returns to the position change.



↑ decrease the vertical CFM box size
↓ increase the vertical CFM box size
→ increase the horizontal CFM box size
← decrease the horizontal CFM box size

8.2.2 CFM Gain Control

CFM Gain must be adjusted properly to ensure that continuous flow is displayed, where appropriate. CFM Gain should be set as high as possible without displaying random Color speckle. If you set the CFM Gain control too low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.



[Active Mode] key

When the GAIN control is turned clockwise the Color gets more intense.

When the GAIN control is turned counterclockwise the Color gets less intense.

8.2.3 Quality

This control improves the Color Resolution by reducing the image frame rate alternatively it reduces the Color Resolution by increasing the image frame rate.



Quality control (Menu control) There are three steps for the Color Quality:

high: higher Color resolution/ lower frame rate

norm: normal Color resolution/ medium frame rate

low: lower Color resolution/ higher frame rate

Remarks:

- The current quality status is displayed in the status area and on the screen [Qual ...]

8.2.4 WMF

The WMF control is used to change the wall motion filter.

The settings are: low1, low2, mid1, mid2, high1, high2 and max.



Use the [WMF] Menu control to adjust the required Wall Motion Filter. Press up increases the filter. Press down decreases the filter.

Remarks:

- The Wall Motion Filter is user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting..

- The suitable WMF-filter is automatically calculated and adjusted when the PRF is changed.

8.2.5 PRF (Velocity Range)

The displayed velocity range is governed by the pulse repetition frequency (PRF). As you increase PRF the velocity range increases. As the display scale increases, the maximum Doppler shift information that can be displayed without aliasing increases accordingly. Aliasing is where the blood velocity exceeds the maximum measurable velocity, causing the displayed flow within the vessel to portray flow in the wrong direction. The disadvantage of using a higher PRF is a loss of sensitivity to low flow velocities.



Use the [PRF] Menu control to adjust the velocity range. Switching up - the PRF increases. Switching down - the PRF decreases

If a selected PRF is unavailable for the selected depth the PRF will be automatically reduced.

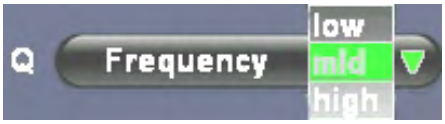
Changing the PRF display unit from kHz to m/s or cm/s be done in the CFM Sub Menu.

Remarks:

- The current sampling frequency is displayed on the screen [PRF ...]

8.2.6 Frequency

The frequency setting controls the Transmit Frequency. It is common to work with the Transmit Frequency that is the center frequency [Mid] of the ultrasound crystal. With a higher Transmit Frequency [High] lower flow velocities are displayed at a given PRF (advantage: better display of lower flow velocities), but the penetration depth is reduced. With a lower Transmit Frequency [Low] the aliasing velocity is increased at a given PRF (advantage: display of higher flow velocities), with increased flow sensitivity with depth.



In the submenu, switch the [Frequency] key to open the dropdown menu and select the suitable transmit frequency.

low: The transmit frequency is lower than the center frequency of the crystal. mid:The transmit frequency is the center frequency of the crystal. high:The transmit frequency is higher than the center frequency of the crystal.

For more information see 'Settings' *on page 18-8.*

8.2.7 Invert

This function inverts the color display in relation to the direction of the flow. The color of the color wedge inverts around the baseline.

	key unlit:	Normal:	Flow to the transducer RED. Flow away from the transducer BLUE.
	key lit:	Inverted:	Flow to the transducer BLUE. Flow away from the transducer RED.

8.2.8 2D + 2D/C

The “2D+2D/C” function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.

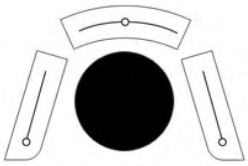


Switch on/off this mode by selecting the [2D+2D/C] item.

8.2.9 Threshold

After **[Freeze]** you can adjust the Color Threshold. This function eliminates small color noise or motion artifact signals in the Color image or alternatively can be viewed as similar to the gain control in write mode.





To change the value scoll with the trackball:

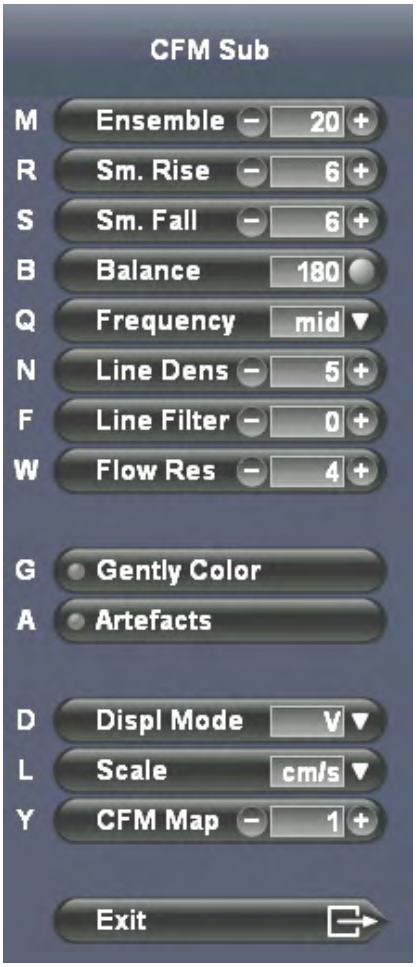
A small number cuts off fewer signals than a higher number.

8.3 CFM Sub Menu

The “CFM Main” menu has to be active.



Select the [Sub Menu] item.



Note *Changes are only possible in write mode!*

Note *Changes in the Gray Chroma Map, Display Mode, Scale, CFM Map and Baseline are also possible in read mode.*

The following functions are available:

- 'Display Modes' *on page 8-8*
- 'Rendering mode' *on page 10-28*
- 'Line Filter' *on page 8-10*
- 'Gently Color' *on page 8-11*
- 'Artifact Suppression' *on page 8-11*
- 'Baseline' *on page 8-11*
- 'Ensemble' *on page 8-12*
- 'Line Density' *on page 8-12*
- 'CFM Map' *on page 8-12*
- 'Balance' *on page 8-13*
- 'Flow Resolution' *on page 8-14*
- 'Smoothing' *on page 8-14*

8.3.1 Display Modes

The following Color display modes can be selected: Velocity, Turbulence (also Variance) and their combinations Velocity and Turbulence, Velocity and Power, Power and Turbulence.



The Velocity display shows the speed and direction of the blood flow. The Turbulence display shows the variation of the blood flow (turbulent flows).

Switch the [Displ Mode] key to open the dropdown menu and select the desired display mode.

Display of velocity (V)

Direction and velocity are color-coded in two-color scale:

- Flow toward the probe = RED
- Flow away from probe = BLUE

		low flow < ---- > high flow
CFM Map 1	Forward flow:	dark red – orange – light orange
	Reverse flow:	dark blue – light blue - cyan
CFM Map 2	Forward flow:	dark red –orange
	Reverse flow:	dark blue – light blue
CFM Map 3	Forward flow:	dark red – orange
	Reverse flow:	dark blue – green
CFM Map 4	Forward flow:	light red – pink
	Reverse flow:	dark blue – violet
CFM Map 5	Forward flow:	dark red – orange – yellow
	Reverse flow:	dark blue – light blue – cyan
CFM Map 6	Forward flow:	dark red – orange – yellow
	Reverse flow:	dark blue – light blue – green
CFM Map 7	Forward flow:	dark red – red
	Reverse flow:	dark blue – blue
CFM Map 8	Forward flow:	dark red – orange – yellow
	Reverse flow:	dark red – orange – yellow

Low flow is displayed by dark red or dark blue (depending on the direction). With increasing velocity the color changes from dark red to yellow respectively from dark blue to white (depending on the selected CFM Map curve).

Display of Turbulence (T)

The Turbulence is coded in a single color wedge:

Less turbulent:	dark green (low brightness)	more turbulent:	light green (high brightness)

Display of Velocity and Turbulence (V-T)

This is the Mode for high flow with turbulence (display of variance).

		low flow < ---- > high flow
CFM Map 1	Forward flow:	dark red – light red
	- Turbulence:	dark orange – orange
	Reverse flow:	dark blue – light blue
	- Turbulence:	dark green – green
CFM Map 2	Forward flow:	red – orange
	- Turbulence:	dark yellow – yellow
	Reverse flow:	blue – cyan
	- Turbulence:	green – light green
CFM Map 3	Forward flow:	dark red – light red – yellow
	- Turbulence:	dark red – green
	Reverse flow:	dark blue – light blue – cyan
	- Turbulence:	dark blue – light green
CFM Map 4	Forward flow:	red – light red
	- Turbulence:	yellow – light green
	Reverse flow:	blue – cyan
	- Turbulence:	green – light green
CFM Map 5	Forward flow:	dark red – yellow
	- Turbulence:	dark green – green
	Reverse flow:	dark blue – cyan
	- Turbulence:	dark green – light green
CFM Map 6	Forward flow:	red – yellow
	- Turbulence:	green – light green
	Reverse flow:	blue – cyan
	- Turbulence:	dark green – light green
CFM Map 7	Forward flow:	dark red – light red
	- Turbulence:	green – light green
	Reverse flow:	violet – light violet
	- Turbulence:	green – light green

Low flow is displayed by dark red or dark blue (depending on the direction). With increasing velocity the color changes from dark red to yellow (depending on the selected CFM Map curve) review: 'CFM Map' *on page 8-12*.

Display of Velocity and Power (V-Pow)

Direction and velocity are coded in two color wedges:

		low flow < ---- > high flow
CFM Map 1	Forward flow:	dark red – light red
	- Power:	violet – light violet (pink)
	Reverse flow:	dark blue – blue
	- Power:	violet – cyclame
CFM Map 2	Forward flow:	dark red- light red – yellow
	- Power:	dark green – light green
	Reverse flow:	dark blue – light blue – cyan
	- Power:	dark green – light green
CFM Map 3	Forward flow:	red – yellow
	- Power:	green – light green
	Reverse flow:	blue – cyan
	- Power:	green – light green
CFM Map 4	Forward flow:	dark red – light yellow
	- Power:	dark violet – violet
	Reverse flow:	dark blue – blue – cyan
	- Power:	dark violet - violet

The Power is the amplitude of Doppler echoes, displayed as brightness in the image.

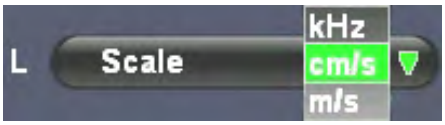
Display of Power and Turbulence (Pow-T)

Color coded in a single color wedge:

	Power:		Turbulence:
Low flow:	dark violet	->	dark green
High flow:	light violet	->	light green

8.3.2 Scale

The maximum velocities are displayed above and under the color scale. (kHz, cm/s, m/s)

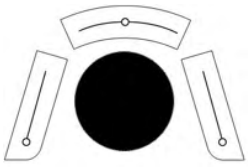


kHz: Doppler shift frequency cm/s: flow velocity m/s: flow velocity

8.3.3 Line Filter

The amount of lateral filtering can be selected to provide a balance between the lateral resolution and image noise.





Seven steps are provided.

To change the value scoll with the trackball:

8.3.4 Gently Color

Gently defines the transition between color and gray scale information. With [Gently Color] the embedding of the color into 2D mode is performed smoothly with less color flash. Consequently color-vessels are softly bordered and have a less digital appearance.



Switch on/off the Gently Color in the CFM Submenu.

8.3.5 Artifact Suppression

Artifact suppression reduces the display of movement artifacts in the image.

For cardiac application it is recommended to switch off the artifact suppression.



Switch on/off the artifact suppression in the CFM Submenu.

8.3.6 Baseline

The CFM baseline shift can be used to prevent aliasing in one flow direction similar to the PW Doppler baseline shift. Shifting the CFM baseline enlarges the velocity range in one direction. The zero line of the color bar is also shifted.



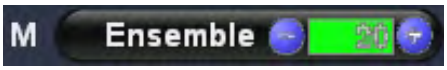
There are 8 Steps in each direction. By step 8 you see only the color wedge in one direction (maximum velocity). The other direction is 0 (kHz, cm/s , m/s).

Only possible in Display Mode V, V-T and V-Pow

The maximum value and minimum value of the flow velocities are displayed at the upper and lower edge of the color wedge.

8.3.7 Ensemble

This function controls the number of pulses for one displayed Color-Doppler line. Since several pulses are to be evaluated for display of a result, the color display quality increases with the number of evaluated pulses. With increasing CFM Ensemble the frame rate decreases.





To increase or decrease use the Trackballbuttons:

max. value: 31

min. value: 7

step size: 1

8.3.8 Line Density

This function determines the line density within the CFM box. The lower the line density, the greater the distance between lines and the size of the color pixels.





To increase or decrease use the Trackballbuttons:

max. value: 10

min. value: 1

step size: 1

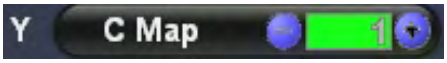
8.3.9 CFM Map

This function allows selection of the color-coding for the blood flow display (similar to the post-processing curves with gray scale 2D). It is useful especially with low flow rates. It may be altered in real time or Freeze mode, respectively.

Velocity display (Display V), velocity-turbulence display (Display V-T) and velocity-power display (Display V-Pow) each have different color pattern maps available for selection.

Selection of a CFM Map curve:

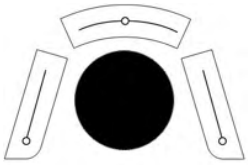


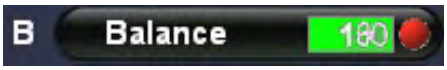


To increase or decrease use the Trackballbuttons:

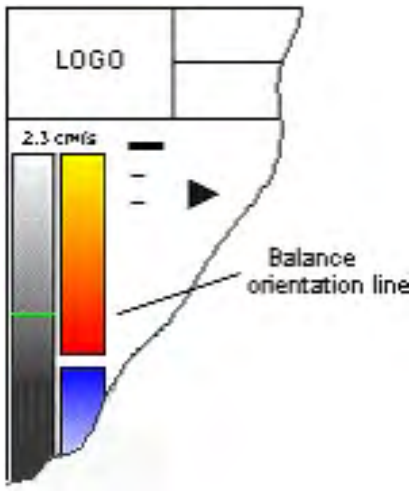
8.3.10 Balance

“Balance” controls the amount of Color displayed over bright echoes and helps confine Color within the vessel walls. Raising this Balance displays Color on brighter structures. If you see Color on vessel walls, the Balance is probably set too high. Additionally, wall motion ghosting can be suppressed with a low Balance setting.





To change the value scoll with the trackball:



The Balance orientation line is only visible in the color modes. The line represents to the position of the adjusted gray value in the gray scale.

Where the balance orientation line is on a gray step, the gray value will be displayed (only if a color value is present, of course). For example, if the gray value is higher than 96 while a color value is present, the gray value will be displayed.

8.3.11 Flow Resolution

This function controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.

With a higher value the color samples in the axial direction are shorter.





To increase or decrease use the Trackballbuttons:

When scrolling right the color information is sharper (edges more pixely). When scroll left the color information is less sharp (edges smoothed).

8.3.12 Smoothing

Smoothing performs a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity.

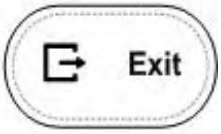




To increase or decrease use the Trackballbuttons.

RISE:	Filtering of the rise velocity leads to noise suppression. To be used with small laminar flows. Avoid quick movements of the probe, because the flow is "built up" slowly. When displaying pulses the Rise-Filter must be set low.
FALL:	This filter leads to prolongation of the displayed flow. To be used with quick pulses (short "color flashes") to prolongate them for better evaluation on the monitor.

8.3.13 Exit the CFM Submenu



Press the **[Exit]** key on the control panel to exit the CFM Submenu.

8.4 CFM + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Color-Doppler and Spectral Doppler.

There is one possibility to combine Color Flow mode (CFM) with Spectral Doppler Information:



To start the Triplex mode press the trackball key [Simult].



To start the Dual mode (only 2D+PW) press the trackball key [Update].

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Chapter 9

PD Mode (Power-Doppler Mode)

Describes the Power Doppler Mode.

PD Mode (Power-Doppler Mode)

Sonographic diagnostics can be greatly extended by Color-Doppler sonography. Still, Color-Doppler sonography has deficits, especially in displaying very slow flow velocities - such as neovascularization to be found in malignant tumors. Power-Doppler intends to erase this deficit by displaying such slow flow velocities. In gynecologic and obstetric applications the advantages can be clearly seen in the display of placental blood circulation. With an eutrophic fetus the blood flow can be seen over the total extent of the placenta. In the radiology field too, advantages for slow flows can be seen (e.g, kidney, liver, prostate, etc.).

Advantages when compared to Color-Doppler:

- less dependent on the incident angle
- no aliasing
- less dependent on the direction

Functional description:

Power Doppler Imaging is a color flow mapping technique used to map the strength of the Doppler signal coming from the flow rather than the frequency shift of the signal. Using this technique, the ultrasound system plots color flow based on the number of reflectors that are moving, regardless of their velocity. Power Doppler Imaging does not map velocity; therefore it is not subject to aliasing.

Power-Doppler imaging generates a Color image by using the Doppler principles. This Color image is overlaid onto the 2D image. The Power-Doppler image provides information about the energy (Power) of the blood cell motion. The amplitudes of the Color-Doppler signal are evaluated and displayed with special color-coding. All velocity-determined functions (Baseline, Scale, Display Mode, etc.) are not available in Power-Doppler imaging.

Power-Doppler can be combined with spectral Doppler. Power-Doppler is only possible with electronic transducers.

The PD mode is subdivided in two groups. In these groups you will see how to use PD mode and how to adjust the PD settings.

To use the PD mode review: 'PD Main Menu' *on page 9-2*

To adjust PD setting review: 'PD Sub Menu' *on page 9-6)*

9.1 PD Main Menu



CFM Mode key (hard key)

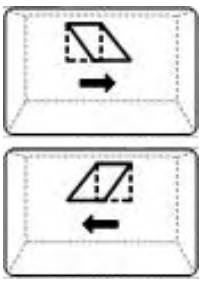
By pressing the control **[Power]** button the PD Mode is switched on and the PD Box appears on the active 2D image.



To use the PD mode review: 'PD Operation' *on page 9-3*

To adjust PD setting review: 'PD Sub Menu' *on page 9-6)*

The “PD Main” menu appears on the screen (write mode).



Remarks:

- Changing Gain, Quality, Frequency, WMF, PRF and 2D+2D/PD is only possible in write mode!
- Beam steering is only possible with linear probe and in write mode.

9.2 PD Operation

The PD operation consists of:

- 'PD Box Position and PD Box Size' *on page 9-3*
- 'PD Gain Control' *on page 9-4*
- 'Quality' *on page 9-4*
- 'Frequency' *on page 9-5*
- 'WMF' *on page 9-5*
- 'PRF (Velocity Range)' *on page 9-5*
- '2D + 2D/PD' *on page 9-6*
- 'Threshold' *on page 9-6*

9.2.1 PD Box Position and PD Box Size

In 2D imaging, the relations between 2D frame rate, line density, and sector width were detailed to show how these three factors can be used to obtain optimal 2D images. A similar relationship exists in Power-Doppler imaging. On the PD Submenu the line density selection adjusts the balance between the 2D line density and the PD line density. The values available are scan head-dependent.

The ability to change the PD Box size and position provides flexibility in Power-Doppler imaging.

The trackball changes the PD Box size and position.

Use the trackball to adjust the PD Box position on the 2D image (Single, Dual, Quad).



←→ PD box horizontal position

↑↓ PD box vertical position

The box is adjustable within the entire 2D image area.



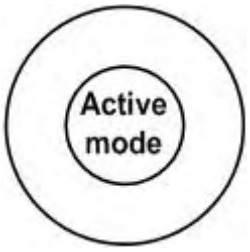
Press the upper trackball key to change from PD Box position to PD Box size. Press it once more and it returns to the position change.



↑ decrease the vertical PD box size
↓ increase the vertical PD box size
→ increase the horizontal PD box size
← decrease the horizontal PD box size

9.2.2 PD Gain Control

PD Gain must be adjusted properly to ensure that continuous flow is displayed, where appropriate. PD Gain should be set as high as possible without displaying random Color speckle. If you set the PD Gain control to low, the lack of sensitivity will make it difficult to detect small abnormalities in flow and will result in an underestimation of the large flow disturbances.



[Active mode] key: Rotating adjusts the intensity of the PD signal.

When the GAIN control is turned clockwise Color becomes more intense.

When the GAIN control is turned counterclockwise Color becomes less intense.

9.2.3 Quality

This control is used to improve the color resolution by reducing the frame rate, or to reduce the color resolution by increasing the frame rate.



There are three steps for the Color Quality.

high: higher Color resolution/ lower frame rate

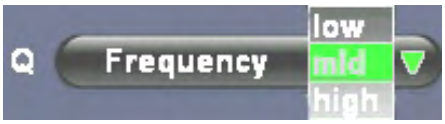
norm: normal Color resolution/ medium frame rate

low: lower Color resolution/ higher frame rate

Remark: The current quality status is displayed in the status area and on the screen [Qual ...].

9.2.4 Frequency

The frequency setting controls the Transmit Frequency. It is common to work with the Transmit Frequency that is the center frequency [Mid] of the ultrasound crystal. With a higher Transmit Frequency [High] lower flow velocities are displayed at a given PRF (advantage: better display of lower flow velocities), but the penetration depth is reduced. With a lower Transmit Frequency [Low] the aliasing velocity is increased at a given PRF (advantage: display of higher flow velocities), with increased flow sensitivity with depth.



Switch the [Frequency] key to open the dropdown menu and select the desired center frequency desired.

low: The transmit frequency is lower than the center frequency of the crystal.

mid: The transmit frequency is the center frequency of the crystal.

high: The transmit frequency is higher than the center frequency of the crystal.

For more information see 'Settings' *on page 18-8.*

9.2.5 WMF

Wall motion filters are used to eliminate vessel wall motion noise that is low in velocity but high in intensity. Use a wall filter that is high enough to remove motion artifacts, but that is sensitive enough to display low velocity flows in small vessels. The WMF control is used to change the wall motion filter.

The settings are: low1 , low2 , mid1, mid2, high1, high2 and max.



Use the [WMF] Menu control to adjust the required Wall Motion Filter. Press up increases the filter; press down decreases the filter.

Remarks:

- The wall filters are user-selectable but the actual cutoff frequencies vary depending on the [PRF] control setting.

9.2.6 PRF (Velocity Range)

The velocity range of the display is governed by the pulse repetition frequency (PRF). The [PRF] control changes the display range. Increasing the velocity range setting will increase the PRF. As the display scale increases, the maximum Doppler shift information that can be displayed without alaising increases also.



Pressing the Menu control upwards increases the PRF. Pressing it downwards decreases the PRF.

Depending on the box depth the maximum sampling frequency will be automatically reduced. (If the sampling frequency is not suitable for the selected depth.)

Remarks:

- The current sampling frequency is displayed on the screen [PRF ...].

9.2.7 2D + 2D/PD

The [2D+2D/PD] function changes the single image display to two simultaneous half frames. The left frame shows only the 2D mode image. The right frame shows the 2D mode image also with color information.



Switch on/off this mode by selecting the [2D+2D/PD] item.

9.2.8 Threshold

After **[Freeze]** you can adjust the Power Threshold. This function eliminates small color noise of motion artifact signals in the Color image.





To increase or decrease use the Trackballbuttons:

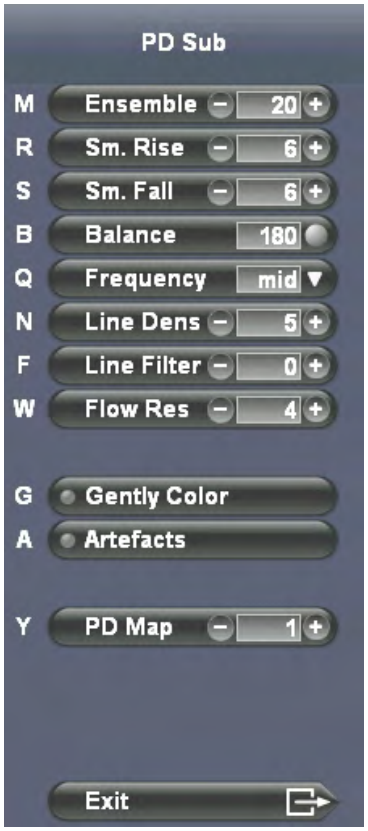
A small number cuts off fewer signals than a higher number.

9.3 PD Sub Menu

The “PD Main” menu has to be active.



Select the [Sub Menu] item.



The functions of the PD Submenu are shown in the menu area as well as in the status area.

Note *Changes are only possible in write mode!*

Note *Only changes in the Gray Chroma Map and PD Map are possible in read mode.*

Following functions are available:

- 'Line Filter' *on page 9-7*
- 'Gently Color' *on page 9-8*
- 'Artefact Suppression' *on page 9-8*
- 'Ensemble' *on page 9-8*
- 'Line Density' *on page 9-9*
- 'PD-Map' *on page 9-9*
- 'Balance' *on page 9-10*
- 'Flow Resolution' *on page 9-10*
- 'Smoothing' *on page 9-11*

9.3.1 Line Filter

Especially lateral resolution can be optimized with this innovative correlation algorithm. With this new process, the signals of the neighboring pulses are less weighted for the display of the actual pulse which considerably improves the detail resolution and signal-to-noise ratio.





To increase or decrease use the Trackballbuttons:

9.3.2 Gently Color

Gently defines the transition between color and gray scale information. With [Gently Color] the embedding of the color into B mode is performed smoothly with less color flash. Consequently color-vessels are softly bordered and have a less digital appearance.



Switch on/off the [Gently Color] function in the PD Submenu.

9.3.3 Artefact Suppression

Artifact suppression reduces the display of movement artifacts in the image.

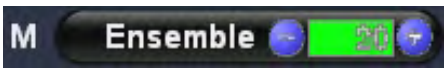
For cardiac application it is recommended to switch off the artifact suppression.



Switch on/off the artifact suppression in the PD Submenu.

9.3.4 Ensemble

This function controls the number of pulses for one displayed Power-Doppler line. Since several pulses are to be evaluated for displaying a result, the color display quality increases with the number of evaluated pulses. With increasing PD Ensemble the frame rate decreases.



Switch the [Ensemble] key and select the number of pulses per color line.



To increase or decrease use the Trackballbuttons:

max. value: 31

min. value: 7

step size: 1

9.3.5 Line Density

This function determines the line density of the Power-Doppler box. The lower the line density, the greater the distance between lines and the size of the color pixel.



Switch the [Line D.] key and adjust the line density. Switch up or down to increase or decrease the line density.



To increase or decrease use the Trackballbuttons:

max. value: 10 min. value: 1 step size: 1

9.3.6 PD-Map

This function allows selection of the color coding for an optimization of the display of blood flow (similar to the post-processing curves with gray scale 2D-scans). It is useful especially with low flow rates. It may be altered in real time or Freeze mode, respectively.





To increase or decrease use the Trackballbuttons:

The Power is the amplitude of Doppler echoes, displayed as brightness in the image.

The color is coded in a color wedge:

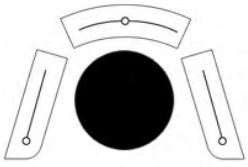
PD Map1	**PD Map 2**	**PD Map 3**	**PD Map 4**
cyclamen	gray-green	brown	dark red
red	violet	red	red
orange	pink	orange	light red
yellow	light yellow	yellow	yellow
PD Map 5	**PD Map 6**	**PD Map 7**	**PD Map 8**
cyclamen	violet	dark blue	dark gray
light red	light violet	light blue	light gray

orange	orange	cyan	white
light yellow	yellow		

Strong echo: lighter hue (high brightness) Weak echo : darker hue (low brightness)

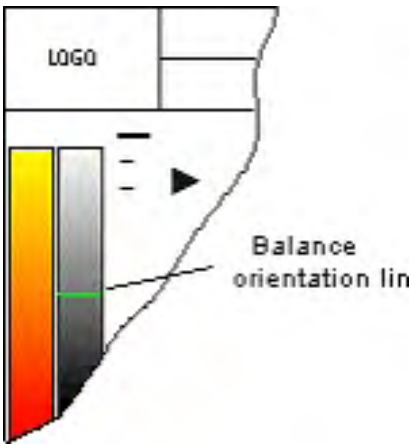
9.3.7 Balance

“Balance“ control establishes the amount of Color displayed over bright echoes and helps confine Color within the vessel walls. Raising this balance displays Color on brighter structures. If you see Color on vessel walls, the balance is probably set too high. Additionally, wall motion ghosting can be suppressed with a low balance setting.





To change the value scoll with the trackball:



The Balance orientation line is only visible in the color modes. The line represents the position of the adjusted displayed gray value in the gray wedge.

Where the balance orientation line is on a gray step, the gray value will be displayed (only if a color value is present, of course). For example, if the gray value is higher than 96 while a color value is present, the gray value will be displayed.

9.3.8 Flow Resolution

This function controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.

With a higher value the color samples in the axial direction are shorter.





To increase or decrease use the Trackballbuttons:

When increasing the value the color information is sharper (edges more pixely). When decreasing the value the color information is less sharp (edges smoothed).

9.3.9 Smoothing

A temporal average is determined from several color images, so that different filter periods can be selected for rising velocity and falling velocity.

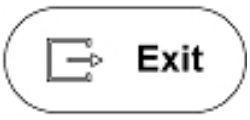




To increase or decrease use the Trackballbuttons:

RISE:	Filtering of the rise velocity leads to noise suppression. To be used with small laminar flows. Avoid quick movements of the probe, because the flow is "built up" slowly. When displaying pulses the Rise-Filter must be set low.
FALL:	This filter leads to prolongation of the displayed flow. To be used with quick pulses (short "color flashes") to prolongate them for better evaluation on the monitor.

9.3.10 Exit the PD Submenu



Press the **[Exit]** key on the control panel to exit the PD Submenu.

9.4 PD + 2D + Spectral Doppler (Triplex Mode)

Triplex mode is the simultaneous real time display of 2D mode, Power-Doppler and Spectral Doppler.

- PD + 2D Mode + PW Doppler (Pulsed Wave Doppler)

9.5 HD Flow

Directional Power Doppler (HD-Flow) is a Power Doppler mode incorporating the flow direction (much like Color Doppler) into the displayed image. The focus of the settings for Directional Power Doppler is for high spatial resolution and low artefact visibility, allowing vessels to be seen with less blooming and finer detail.

HD-Flow Mode is available in 2D Mode, M-Mode and Fetal Cardio.

The HD-Flow mode is subdivided in two groups. In these groups you will see how to use HD-Flow mode and how to adjust the HD-Flow settings.

9.5.1 HD-Flow Main Menu



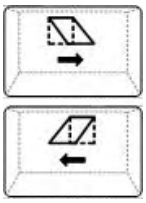
Press the [CFM] key to switch on Color Flow Mode.

	Select the HD-Flow item in the side menu.

Note *Once HD-Flow has been activated, it is automatically active each time the [CFM] hardkey is pressed.*

	The HD-Flow Main Menu appears in the left menu bar. Select the desired program.
	Toggle combined 2D and HD-Flow display. Activating this button switches to dual view whereas the left frame displays the 2D mode image without color information and the right frame the HD-Flow image.
	Select this item to invoke the HD-Flow sub menu. 'HD-Flow Sub Menu' *on page 9-14*

	Adjust the color resolution. 'Quality' *on page 9-4*
	Adjust the wall motion filter. 'WMF' *on page 9-5*
	Adjust the zoom level. 'Read Zoom' *on page 5-13*
	Adjust the pulse repetition frequency. 'PRF (Velocity Range)' *on page 9-5*



Adjust the steering angle. 'Beam steering' *on page 5-8*

Changing the Quality, WMF, PRF, Steering and 2D+2D/HD is only possible in scan mode!

The HD-Flow Box appears in the active 2D image.

- Beam steering is only possible with linear probe and in scan mode.

9.5.2 HD-Flow Operation

9.5.2.1 HD-Flow Box Position and HD-Flow Box Size

In 2D imaging, the relations between 2D frame rate, line density, and sector width were detailed to show how these three factors can be used to obtain optimal 2D images. A similar relationship exists in Power-Doppler imaging. On the HD-Flow Submenu the line density selection adjusts the balance between the 2D line density and the HD-Flow line density. The values available are scan head-dependent.

The ability to change the HD-Flow Box size and position provides flexibility in Power-Doppler imaging. The trackball changes the HD-Flow Box size and position.

Use the trackball to adjust the HD-Flow Box position on the 2D image (Single, Dual, Quad).



← → HD-Flow box horizontal position

↑ ↓ HD-Flow box vertical position

The box is adjustable within the entire 2D image area.



The upper trackball key switches between HD-Flow Box position and HD-Flow Box size. Press the upper trackball key to change from HD-Flow Box position to HD-Flow Box size. Press it once more and it returns to the position change.



↑ decrease the vertical HD-Flow box size

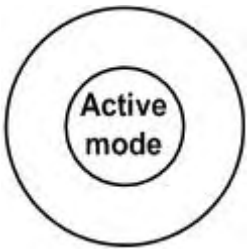
↓ increase the vertical HD-Flow box size

→ increase the horizontal HD-Flow box size

← decrease the horizontal HD-Flow box size

9.5.2.2 HD-Flow Gain Control

HD-Flow Gain must be adjusted properly to ensure that continuous flow is displayed. HD-Flow Gain should be set as high as possible without displaying random Color speckle. If you set the HD-Flow Gain control too low, then the lack of sensitivity will make it difficult to detect small abnormalities in flow and will possibly result in an underestimation of the large flow disturbances.



[Active mode] key: Rotating adjusts the intensity of the HD-Flow signal.

When the GAIN control is turned clockwise Color becomes more intense. When the GAIN control is turned counterclockwise Color becomes less intense.

Changing the Gain is only possible in scan mode!

9.5.2.3 Invert

This function inverts the color display in relation to the direction of the flow. The color of the color wedge inverts around the baseline.

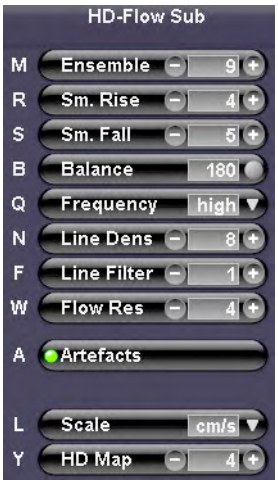


key unlit:	Normal:	Flow to the transducer RED Flow away from the transducer BLUE
key lit:	Inverted:	Flow to the transducer BLUE Flow away from the transducer RED

9.5.3 HD-Flow Sub Menu

The “HD-Flow Main” menu has to be active.

Select the Sub Menu item or press the [S] key. The HD-Flow Submenu appears.



- Ensemble 'Ensemble' *on page 9-15*
- Smoothing 'Smoothing' *on page 9-15*
- Balance 'Balance' *on page 9-10*
- Frequency 'Frequency' *on page 9-16*
- Line Density 'Line Density' *on page 9-16*
- Line Filter 'Line Filter' *on page 9-16*
- Flow Resolution 'Flow Resolution' *on page 9-16*
- Artefact Suppression 'Artefact Suppression' *on page 9-17*
- HD Map 'HD Map' *on page 9-17*
- Gray Map *For more information see* ' Gray Chroma Map' *on page 11-2.*
- Utilities *For more information see Chapter 11.*

Note *Most changes are only possible in scan mode. Only changes in the HD Map are possible in freeze mode.*

Following functions are available:

9.5.3.1 Ensemble

This function controls the number of pulses for one displayed Power-Doppler line in the display. Since several pulses have to be evaluated to display a result, the color display quality increases with the number of evaluated pulses. With increasing HD-Flow-Ensemble the frame rate decreases.

Press +/- on the [Ensemble] menu item to select the number of pulses per color line.



max. value:	31
min. value:	7
step size:	1

9.5.3.2 Smoothing

Smoothing performs a temporal averaging which improves the appearance of the color images. Different amounts of smoothing can be selected for rising velocity and falling velocity.



Press +/- on the [Sm. Rise] menu item to select the rise filter.

RISE: Filtering of the rise velocity leads to noise suppression. To be used with small laminar flows. Avoid quick movements of the probe, because the flow is "built up" slowly. When displaying pulses the Rise-Filter must be set low.



Press +/- on the [Sm. Fall] key to select the fall filter.

FALL: This filter leads to prolongation of the displayed flow. Usage with quick pulses (short "color flashes") prolongates them for better evaluation on the monitor.

9.5.3.3 Frequency

The frequency setting controls the Transmit Frequency. It is common to work with the center frequency [Frequ. Mid] of the ultrasound crystal. With a higher Transmit Frequency [Frequ. High] lower flow velocities are displayed at a given PRF (advantage: better display of lower flow velocities), but the penetration depth is reduced. With a lower Transmit Frequency [Frequ. Low] the aliasing velocity is increased at a given PRF (advantage: display of higher flow velocities), with increased flow sensitivity and depth.

Select the desired frequency from the dropdown field in the [Frequency] menu item.



Low: The transmit frequency is lower than the center frequency of the crystal. Mid: The transmit frequency is the center frequency of the crystal. High: The transmit frequency is higher than the center frequency of the crystal.

For more information see 'Settings' *on page 18-8.*

9.5.3.4 Line Density

This function determines the color line density of the HD-Flow box. The lower the line density, the greater the distance between lines and the size of the color pixel.

Press +/- on the [Line Dens] menu item to adjust the line density.



max. value:	10
min. value:	1
step size:	1

9.5.3.5 Line Filter

The amount of lateral filtering can be selected to provide a balance between the lateral resolution and image noise.

Eight steps are provided.

Press +/- on the [Line Filter] menu item and select the filtering.



9.5.3.6 Flow Resolution

This function controls the axial resolution of color in the display. It adjusts the axial sample depth of color pixels.

highcolor samples in axial direction shorter low color samples in axial direction larger

Press +/- on the [Flow Res] menu item and select the axial resolution.



There are four steps for Flow Resolution.

9.5.3.7 Artefact Suppression

Artefact suppression reduces movement artefacts in the image. For cardiac application it is recommended to switch off the artefact suppression.



Switch on/off the artefact suppression in the HD-Flow Submenu.

9.5.3.8 HD Map

This function allows selection of the color coding for an optimization of the display of blood flow (similar to the post-processing curves with gray scale 2D-scans). It is useful especially with low flow rates. It may be altered in real-time or Freeze-Mode, respectively.

The color is coded in a color wedge:

HD Map1	HD Map 2	HD Map 3	HD Map 4
light yellow	white	white	white
red	light red	dark red	dark red
dark blue	light blue	dark blue	dark blue
light blue	white	white	white
HD Map 5	**HD Map 6**	**HD Map 7**	**HD Map 8**
cyan	pink	white	yellow
dark blue	dark red	dark grey	dark red
dark blue	dark red	dark grey	dark red
cyan	Pink	white	yellow

Strong echo: lighter hue (high brightness)

Weak echo : darker hue (low brightness)

Selection of a HD-Flow Map curve:

Press +/- on the [HD Map] menu item to select the HD Map curve.



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Chapter 10

Volume Mode

Describes the Volume 3D/4D Mode and its features.

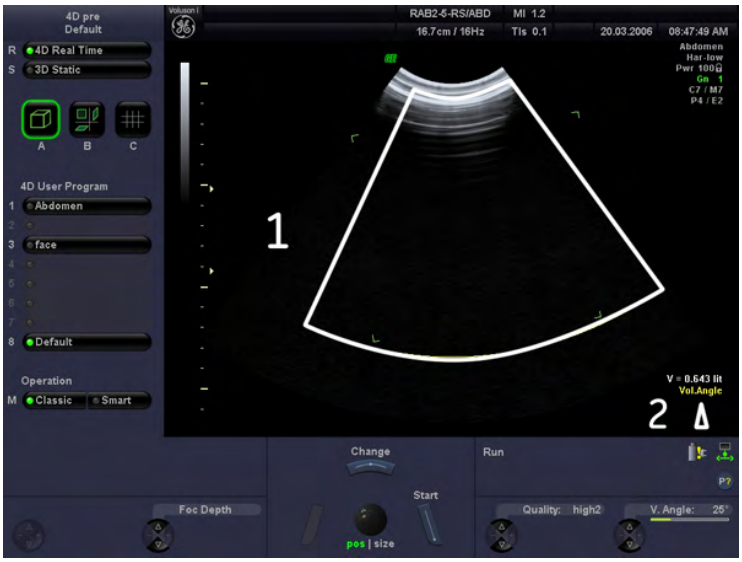
10.1 Getting Started



Volume mode key (hard key)

By pressing the **[4D]** key the Volume mode function is switched on and the Volume box appears on the image area.

The “3D/4D Pre” menu appears on the screen (write mode).



The Volume box appears on the image area.

1. Volume box X Y
2. Volume box Z (sweep angle)

There are different possibilities to perform a 3D static or Real Time 4D Volume Acquisition. See 'Acquisition modes' *on page 10-5* for a list of acquisition modes and their intended application.

10.1.1 The Render Box

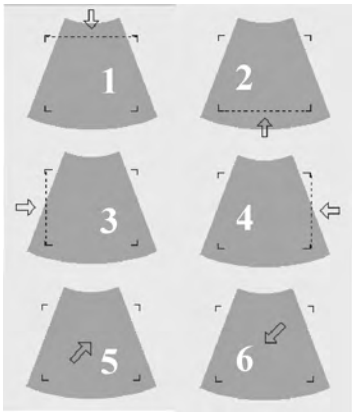
To obtain a good 3D picture, the following three points are very important (similar to a photography):

- the direction of view
- the area/size of view
- free sight to the object (surface mode)

This has to be adjusted with the render box. The render box determines the size of the volume to be rendered. Therefore, objects that are not inside the box will not be included in the render process and cut out (important for the surface mode to cut off objects, which interfere with a free line of sight). The positioning of the box inside the scanned volume is done with help of the orthogonal sectional planes A, B and C, each of which cut through the box in the middle.

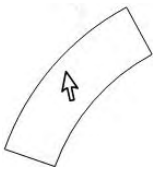
Review the following diagram to understand how the render box determines the direction of view. Six different render box directions are possible.





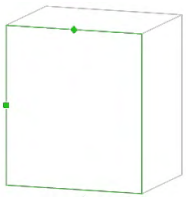
For more information see 'Rendering mode' *on page 10-28.*

10.1.2 3D Screen control

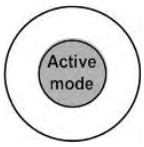


To rotate and control the 3D/4D views activate the mouse pointer and use the screen control icons.

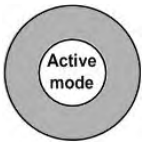
Icon	Screen control	Meaning
	Rotation X	Rotate around X-axis when in ref image A (respective axis in B, C, 3D).
	Rotation Y	Rotate around Y-axis when in ref image A (respective axis in B, C, 3D).
	Rotation Z	Rotate around Z-axis when in ref image A (respective axis in B, C, 3D).
	Parallel Shift	Shift in Z-direction
	Curved render start	Move curved render start

Icon	Screen control	Meaning
	Move	Move around the image
	Borders of renderbox	To resize the renderbox
	Home 3D	Switch 3D rendered image back to initial 3D position.
	Home 3D flat	Toggle between 3D view and flat 3D view.

Alternatively you can change the image orientation by means of the Active Mode Button.



Press the Active mode button to toggle between X Rotation, Y Rotation, Z Rotation and Parallel Shift.



Turn the Active mode wheel in order to perform the previously selected image orientation action.

The 3D/4D Menu is active and orientation markers are displayed in 3D/4D mode.

Note *The Orientation marks appear on the Rotation Axis in the A-, B-, and C-Plane.*

They change according to the rotation of the slices.

Following orientation markers are available:	A	Anterior
	P	Posterior
	L	Left
	R	Right
	Cr	Cranial
	Ca	Caudal

There are also combinations thereof possible e.g.: AL, PRCa etc.

Note *The orientation marks are visible if slices are present in T.U.I. mode (not in Render Full-Screen). They are visible as long as they are not turned off, by pressing [Off] key in Probe Orientation Menu.*

For more information see 'Tomographic Ultrasound Imaging (TUI)' *on page 10-61.*

10.1.3 Sono Render Start

Sono Render Start is not available in all countries.

Sono Render Start helps to adjust the render curve to easily separate solid tissue in front of the render object. The algorithm looks for the transition from liquids to solid tissue. The Render Box size transverse to the render direction and the Render Box position will not be changed.



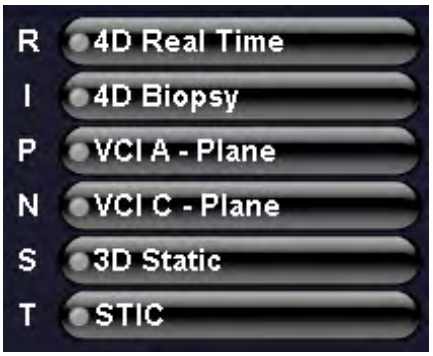
Press the Auto button to calculate the render curve. The following prerequisites have to be met:

- The acquisition mode is “3D read” or “4D read/write” (not possible in Vol. pre)
- The visualization mode is “Render”.
- Edit mode is “On”

If no valid render start area can be found a warning message appears. Re-position the render box and try again.

Double click to undo all Sono Render Start changes.

10.2 Acquisition modes



- '4D Real Time' *on page 10-5*
- '4D Biopsy' *on page 10-16*
- 'Volume Contrast Imaging (VCI A-Plane)' *on page 10-18*
- 'Volume Contrast Imaging (VCI C-Plane)' *on page 10-19*
- 'Volume Acquisition: Static 3D' *on page 10-21*
- 'STIC (Spatio-Temporal Image Correlation)' *on page 10-24*

10.2.1 4D Real Time

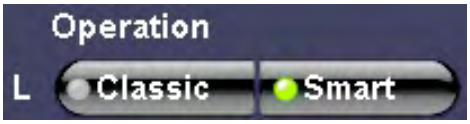
4D Real Time mode is obtained through continuous volume acquisition and parallel calculation of 3D rendered images. In 4D Real Time mode the volume acquisition box is at the same time the render box. All information in the volume box is used for the render process. Therefore size and position of the volume box is important for a good render result. The size of a calculated 3D image is set in that way that the content of the render box fits to the chosen display mode area. After freezing, the 3D image size can be adjusted manually if desired, or

play back the 4D cine. This algorithm ensures that independent from size of the volume box, the entire 3D image will always be displayed in a proper manner.

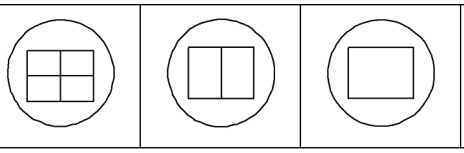
Condition for 4D Real Time:

A 4D Real Time probe is connected and selected.

Software option "4D Real Time" is installed.

Menu item	Description
	Select the Acquisition Mode [4D Real Time] from the menu area.
	Select a 4D User Program (e.g., Default). The preset values are loaded.
	Choose between Classic and Smart operation mode.

Note *Depending on the selected Visualization mode [4D Rendering] or [Sect. Planes], different menus will be displayed during and after the 4D Real Time acquisition.*

	Select the display format desired.

Note *The selected format will be present in read mode after the 4D Real Time acquisition is done. The **[Dual]** screen format key is only available in 4D Real Time Rendering mode!*

Place the Volume box over the region of interest.



The trackball has two functions: position and size of the Volume box
The activated function is displayed in Status area of the trackball.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction

→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

Menu item	Description
	Set the volume sweep angle using the toggle switch shown in the status area.
	Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density This mode is selected only in case of expected movement artifacts. A loss of volume resolution will result
mid 2:	Standard VOL scan / medium scan density
max:	Slow speed/ high scan density



To start 4D acquisition press the **[Freeze]** key, respectively the right trackball key (**Start** -> displayed in Status area of the trackball).



The volume acquisition begins and the acquired images and corresponding functions are displayed on the monitor

Press the **[Freeze]** key again to stop the acquisition.

10.2.1.1 4D Controls



Press the left trackball key to **choose a Reference Image**. Selecting a reference image automatically determines the control functions of the rotary controls and the trackball for the liberal adjustment of a sectional plane. The one chosen for reference is marked yellow. The image plane is highlighted by a box.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

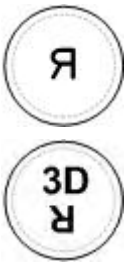
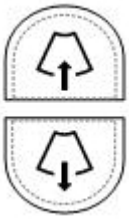


To return to the “4D Pre” menu, press the right trackball key (**Volpre** displayed in the Status area of the trackball).



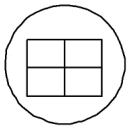
Move the trackball to change the image **pos**ition or the **size** of the volume box. The activated function is displayed in Status area of the trackball.

Menu item	Description
	To switch the User program after acquisition start click the Set Rendering menu item or press the U key.
	**Reset the render curve to its default position** This item resets the render start curve to its default (start) position. Curve adjustment is only possible in Dual and Quad view.
	Adjust Brightness and Contrast of the 3D image.
	**Mix between two render modes.** The mixing can be done in 10% steps from 0% to 100% by using this Menu control. The mix-ratio is displayed in%. This control is only available in the Set Rendering sub menu. For Example: To produce a better, smoothed surface by mixing surface smooth and light mode. **Set the Threshold** (Reject). Normally this threshold must always be adjusted for a good appearance of the 3D surface image. By changing the threshold all echoes below the level are enhanced in pink color for a certain interval. Application: With this function small echoes or noise are removed in order to achieve a "clear vision" from the start border of the render box to the surface of interest.
	**Set the Zoom control** The sectional images (A, B and C) and the 3D image will be magnified from the center of rotation. If ***Edit ROI*** is active only the contents of the ROI box are magnified.
	Press the HI key to turn on Harmonic Imaging. See 'Harmonic Imaging (HI)' *on page 5-7* for further info.

Menu item	Description
	**Select Image Orientation of 4D Real Time image** With these keys the image orientation of the 3D image can be changed. The image orientation of the sectional planes is not changed. **Remark:** The 3D image orientation can be changed in read- or write mode.
	**Change the Penetration depth** Select the penetration depth of the 2D image.

10.2.1.2 Display of Sectional Planes

Continuous volume sweep. Display of sectional planes without 3D image



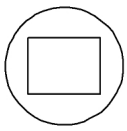
The unit displays continuously the sectional planes during the acquisition of a Real Time 4D volume.





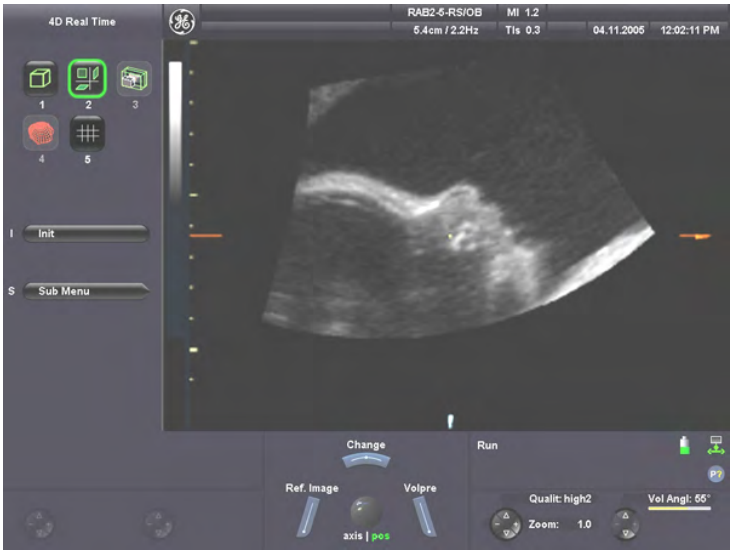
10.2.1.3 Display of REF-Image

Continuous volume sweep. Display of Full size of the reference sectional plane without 3D image



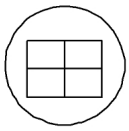
The unit displays continuously only the REF image plane during Real Time 4D acquisition.



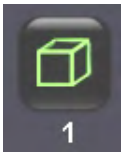


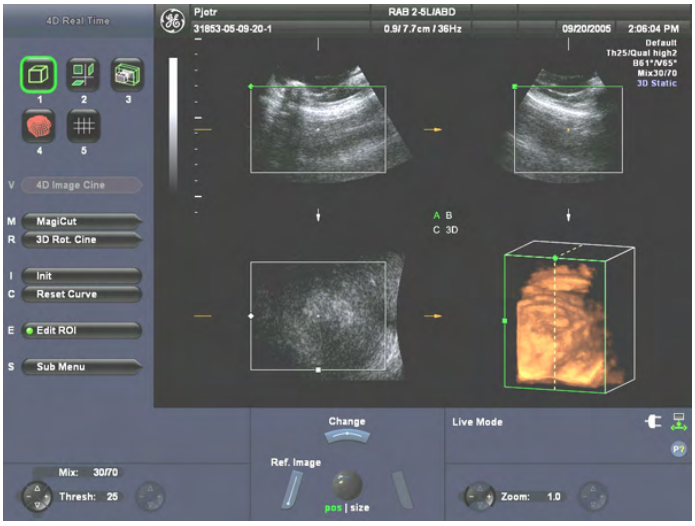
10.2.1.4 Display of ROI 4D

Continuous volume sweep (Real Time 4D) Quarter size display of a rendered 3D image + sectional planes



The unit displays continuously the ROI and 4D image during acquisition of a Real Time 4D volume.

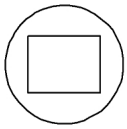




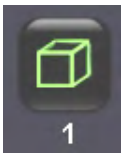
To use the controls during the Real Time 4D acquisition review: '4D Controls' *on page 10-7*

10.2.1.5 Display of 4D

Continuous volume sweep (Real Time 4D) Full size display of a rendered 3D image.



The unit displays continuously only the 4D image during the acquisition of a Real Time 4D volume.

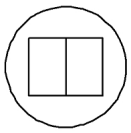




To use the controls during the Real Time 4D acquisition review: '4D Controls' *on page 10-7*

10.2.1.6 Display of A-ROI 4D

Continuous volume sweep (Real Time 4D) Dual size display of a rendered 3D image + Reference image A.



The unit displays the REF and 4D image continuously during acquisition of a Real Time 4D volume.

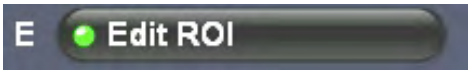




To use the controls during the Real Time 4D acquisition review: '4D Controls' *on page 10-7*

10.2.1.7 4D ROI (Edit ROI) Mode

This is the mode for the adjustment of the volume render box. The volume rendering box determines the ROI for the 4D calculation which is inserted in the orthogonal planes A, B, C. The rendering result is displayed in the lower right quadrant.



The [Edit ROI] key is in the “Real Time 4D”, “ROI 4D”, “A-ROI 4D” menu available.

The adjustments of Content, Size and Curvature of the Render Box are the same as in the 3D Menu.

For more information see 'The Render Box' *on page 10-2.*

10.2.1.8 Accept ROI Mode



The [Accept ROI] key is in the “Real Time 4D”, “ROI 4D”, “A-ROI 4D” menu available.

The adjustments are the same as in the 3D Menu.

10.2.1.9 After the 4D Real Time Acquisition

After **[Freeze]** the system switches automatically to read mode and the “4D Cine” menu appears. The selected format will be present on the monitor.



Auto Cine Start/Stop



Press the left trackball key [Start] to activate the 4D Cine. By pressing the left trackball key, the last 64 frames of a 4D Real Time sequence will be displayed image by image with the trackball.



To return to the “4D Pre” menu, press the right trackball key (**Volpre** displayed in the Status area of the trackball).

Menu item	Description
	**Loop Mode Direction** Scan in both directions through the image block: First image...last image, last image...first image, etc. Scan in one direction through the image block: First image...last image, first image...last image, etc.
	**Cine Speed** The speed of sequencing through the number of images can be varied between 6%, 12%, 25%, 50%, 100%, 200%, and 400%.
	Click this menu item or press S key to set the start of the cine loop. Use the trackball to navigate through the image sequence and press any trackball key to set the start point.
	Click this menu item or press E key to set the end of the cine loop. Use the trackball to navigate through the image sequence and press any trackball key to set the end point.

10.2.1.10 Real Time 4D Acquisition During Active High Resolution Zoom

It is possible to switch to 4D



While in 2D mode, press the **[Zoom]** key.

Place the zoom box over the region of interest.



The trackball has two functions: adjusting position and size of the zoom box.

The activated function is displayed in Status area of the trackball.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

3. Change the size of the zoom box by moving the trackball.

Moving:

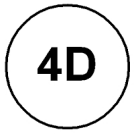
↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction



4. Press the **[Zoom]** key again to activate the High Resolution Zoom. Alternative press the right trackball key.

The overview window appears.

To readjust overview window settings: *For more information see* 'User Settings' *on page 16-8.*



5. Press the **[4D]** key to activate Volume mode.



6. Select the desired Visualization mode.

Operation: Real Time 4D Acquisition '4D Real Time' *on page 10-5*

Remarks:

- Real Time 4D Acquisition is not possible in PD- and CFM mode.
- The overview window is hidden when 3D/4D mode is activated. It appears again, if the 3D/4D mode is deactivated again.



Press the **[Zoom]** key again to exit the High Resolution Zoom function.

10.2.2 4D Biopsy

Note *4D Biopsy is optional. Please contact your local sales representative for further information.*

- Before performing a 4D Biopsy, make sure that the displayed biopsy line coincides with the needle track. (check in a bowl filled with approx. 47ºC warm water!)
- The biopsy lines must be programmed once by the service personnel or the user. The procedure must be repeated if probes and /or biopsy guides are exchanged.
- Please read the Instructions for safe use in Biopsy Special Concerns 'Biopsy Special Concerns' *on page 18-14*.

Note *The biopsy line must be programmed! Otherwise activating the [4D Biopsy] key is impossible. See:* ' To program a Single Angle Biopsy Line' *on page 17-22*

To program a Multi Angle Biopsy Line 'To program a Multi Angle Biopsy Line' *on page 17-23*

10.2.2.1 Starting the Acquisition

Menu item	Description
	Select the acquisition mode [4D Biopsy] from the menu area.
	Select a 4D User program (e.g. Default). The preset values are loaded.
	Select the desired “Biopsy Mode” **Guided:** 2D image + biopsy line + volume box are shown on the screen. **Freehand:** 2D image + volume box are shown on the screen. (no biopsy line)

Place the Volume box over the region of interest.



The trackball has two functions: position and size of the Volume box. The activated function is displayed in Status area of the trackball.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

Change the size of the Volume box by moving the trackball.

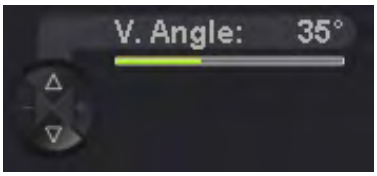
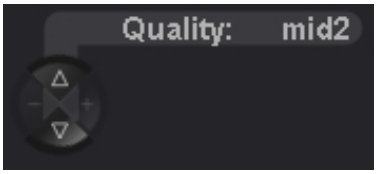
Moving:

↑ decrease the box size in vertical direction

↓ increase the box size in vertical direction

→ increase the box size in horizontal direction

← decrease the box size in horizontal direction

Menu item	Description
	Set the volume angle by means of the menu soft buttons.
	Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density This mode is selected only in case of expected movement artefacts. A loss of volume resolution will result
mid 1	intermediate level
mid 2:	Standard VOL scan / medium scan density
high 1	intermediate level
high 2	intermediate level
max:	Slow speed/ high scan density



To start 4D acquisition press the **[Freeze]** key, respectively the right trackball key (**Start** -> displayed in Status area of the trackball).



The volume acquisition starts and the acquired images and corresponding functions are displayed on the monitor.

10.2.2.2 During 4D Biopsy

To select 3D Orientation (Mirror View)



With this function it is possible to change the render-view direction (green line) to the opposite side. Switch on/off the Mirror View.s

10.2.2.3 Ending the 4D Biopsy

Press the Freeze Button to end the 4D Biopsy acquisition.

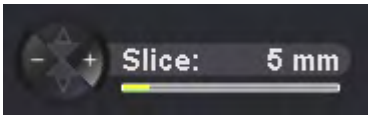
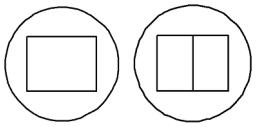
10.2.2.4 After the 4D Biopsy

After **ending the acquisition** the system switches automatically to read mode and the “4D Cine” menu appears. The selected format will be present on the monitor.

10.2.3 Volume Contrast Imaging (VCI A-Plane)

Note *Volume Contrast Imaging is an option. If this option is not installed, the [VCI A-Plane] key is hidden.*

By setting a small sweep angle you can scan a limited number of slices with a relatively high volume rate. The rendering box is very small and so you can visualize the tissue information of a thick slice.A mixture of surface texture and transparent maximum rendering modes (70/30) plus a low setting of surface transparency (20-50) is used.The resulting image shows the average (integrated) gray value of the tissue contained within the narrow box.Volume Contrast Imaging [VCI] improves the contrast resolution and the signal / noise ratio and therefore facilitates finding of diffuse lesions in organs.The result is an image with no speckle pattern and a highly improved tissue contrast.

Menu item	Description
	Select the [VCI A-Plane] key.
	Select a VCI-A user setting (e.g., Default). The preset values are loaded.
	Select the “Slice Thickness” by selecting it in the menu.
	Select the desired screen format.

Note *The selected format will be present in read- and write mode!*

Place the Volume box over the region of interest.



The trackball has two functions: position and size of the Volume box.The activated function is displayed in status bar area on the monitor.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

Change the size of the Volume box by moving the trackball.

Moving:

↑ decrease the box size in vertical direction

↓ increase the box size in vertical direction

→ increase the box size in horizontal direction

← decrease the box size in horizontal direction

Menu item	Description
	Select the Quality. This function changes the line density against acquisition speed.



To start the VCI-A acquisition press the [Freeze] key or the right trackball key (Start displayed in Status bar area on the monitor).



The volume acquisition starts and the acquired images are displayed.

Press the [Freeze] key again to stop the acquisition.

10.2.3.1 After the VCI-A Acquisition

After [Freeze] the system switches automatically to read mode and the “Vol. Cine” menu appears. The selected format and the last acquired volume will be present on the monitor.

Upon [Freeze] a certain number of volumes will be stored in the cine memory.The sequence can be reviewed volume by volume.

10.2.4 Volume Contrast Imaging (VCI C-Plane)

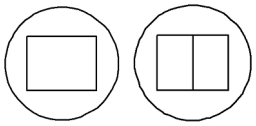
Note *Volume Contrast Imaging is an option. If this option is not installed, the [VCI C-Plane] key is hidden.*

By setting the necessary sweep angle for the desired ROI, the system provides a coronal plane (VCI C-Plane). The rendering box is very thin and so you can visualize the tissue information of a thick slice.A mixture of surface texture and transparent maximum rendering modes (70/30) plus a low setting of surface transparency (20-50) is used.The resulting image shows the average (integrated) gray value of the tissue contained within the narrow box.Volume Contrast Imaging [VCI] improves the contrast resolution and the signal / noise ratio and therefore facilitates finding of diffuse lesions in organs.The result is an image with no speckle pattern and a highly improved tissue contrast.

Menu item	Description
	Select the [VCI C-Plane] key.
	Select a VCI-C user setting (e.g., Default). The preset values are loaded.



Move the horizontal green dotted line with the trackball to the desired position of the ultrasound image on the screen.

Menu item	Description
	Select the “Slice Thickness” and Volume Angle by selecting it in the menu.
	Select the desired screen format.

Note *The selected format will be present in read- and write mode!*



To start the VCI-A mode press the [Freeze] key or the right trackball key (Start -> displayed in Status bar area on the monitor).



The volume acquisition starts and the acquired images are displayed. Place the Volume slice over the region of interest.



The trackball has two functions: position and rotation of the Volume slice. The activated function is displayed in status bar area on the monitor.



Press the upper trackball key to change the function of the trackball from position to rotation or vice versa.

Change the angle of the Volume slice by moving the trackball.

Moving:

→ rotate the volume slice clockwise

← rotate the volume slice counter-clockwise

Menu item	Description
	Select the Quality. This function changes the line density against acquisition speed.

low:	Fast speed / low scan density (A loss of volume resolution will resultants mode is selected only in case of expected movement artifacts.
mid:	Standard VOL scan / medium scan density
high:	Slow speed/ high scan density

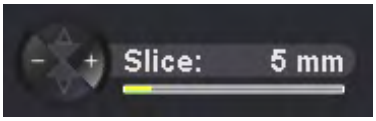
Press the [Freeze] key again to advance to read mode.

10.2.4.1 After the VCI-C Acquisition

After [Freeze] the system switches automatically to read mode and the “Auto Cine” menu appears. The selected format and the last acquired volume will be present on the monitor.

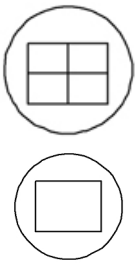
Upon [Freeze] a certain number of volumes will be stored in the cine memory. The sequence can be reviewed volume by volume.

Select the “Slice Thickness” by using the menu control buttons.



Other controls are available for image adjustment (e.g. mixed render modes). '4D Real Time' *on page 10-5*.

10.2.5 Volume Acquisition: Static 3D

Menu item	Description
	Select 3D Static acquisition mode
	Select the desired Visualization mode.
	Select the display format desired.

Note *The selected visualization mode and format will be present in read mode after the acquisition is done and can also be switched then.*

Place the Volume box over the region of interest.



The trackball has 2 functions: position and size of the Volume box.
The activated function is displayed in Status area of the trackball.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

Change the size of the Volume box by moving the trackball.

Moving:

↑ decrease the box size in vertical direction

↓ increase the box size in vertical direction

→ increase the box size in horizontal direction

← decrease the box size in horizontal direction



To start 3D acquisition press the **[Freeze]** key, respectively the right trackball key (**Start** -> displayed in Status area of the trackball).

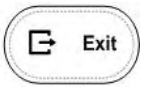
The volume acquisition starts and after a short calculation period the acquired volume is displayed.



Note *If CRI is enabled in 2D Mode, it is also used in 3D Static pre mode and during 3D Static acquisition. The settings (CRI value) are taken from the 2D settings.*

Note *Use of CRI is indicated in the info block.*

During the acquisition of a 3D volume, the unit displays only the volume box area. After acquisition the unit changes to read mode.



To stop the acquisition, press the **[Exit]** key on the control panel. The acquisition stops and the “3D Pre” menu appears again.

Note *The recorded information will be cleared!*

10.2.5.1 After the static 3D acquisition

After the 3D Sectional Planes acquisition, the system switches automatically to the read menu. The selected format will be present on the monitor (e.g., A,B,C - Sectional Plane Mode).

'Rendering mode' *on page 10-28*

'Sectional Planes' *on page 10-41*

'SonoAVC follicle' *on page 10-42*

'VOCAL II*' *on page 10-47*

'Tomographic Ultrasound Imaging (TUI)' *on page 10-61*

'SonoVCAD Heart - Volume Computer Aided Display' *on page 10-63*

10.2.5.2 3D Acquisition During Active High Resolution Zoom

1. Press the **[Zoom]** key.



2. Place the zoom box over the region of interest.

3. Press the [Zoom] key again to activate the Zoombox.



The trackball has 2 functions: position and size of the Volume box. The activated function is displayed in Status area of the trackball.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

4. Change the size of the zoom box by moving the trackball.

Moving:

↑ decrease the box size in vertical direction

↓ increase the box size in vertical direction

→ increase the box size in horizontal direction

← decrease the box size in horizontal direction



5. Press the **[4D]** key to activate Volume mode.

Remark: The overview window is hidden when 3D/4D mode is activated. It appears again, if the 3D/4D mode is deactivated again.



6. Select the desired Visualization mode.

Operation: 'Volume Acquisition: Static 3D' *on page 10-21*

'Rendering mode' *on page 10-28*



Press the **[Zoom]** key again to exit the High Resolution Zoom function.

10.2.6 STIC (Spatio-Temporal Image Correlation)

Note *STIC is optional. Please contact your local sales representative for further information.*

10.2.6.1 Introduction

With this acquisition method the fetal heart or an artery can be visualized in 4D. It is not a Real Time 4D technique, but a post processed 3D acquisition.

- STIC-Fetal Cardio is only available on RAB & RIC probes in the OB/GYN application
- STIC-Vascular is only available on the RSP probe in the Peripheral Vascular application

Data is acquired for a predefined period of time (7.5 – 15 sec.). The acquired images are post processed to calculate a 4D Volume Cine sequence representing one complete heart cycle.

In order to achieve a good result, try to adjust the size of the volume box and the sweep angle to be as small as possible. The longer the acquisition time, the better the spatial resolution will be. The user must be sure that there is minimal movement of the participating persons (e.g., mother and fetus), and that the probe is held absolutely still throughout the acquisition period. Movement will cause a failure of the acquisition. If the user (trained operator) clearly recognizes a disturbance during the acquisition period, the acquisition has to be cancelled.

A good STIC data set shows a regular and synchronous pumping of the fetal heart or of an artery. Please make sure that the borders of the fetal heart or the artery are smooth and there are no sudden discontinuities.

One or more of the following artefacts in the data set indicate a disturbance during acquisition:

- Sudden discontinuities in the reference image B:

  These are due to motion of the mother, the fetus or fetal arrhythmia during acquisition.

- Sudden discontinuities in the color display:

  Motion of the mother, the fetus or fetal arrhythmia affects the color flow in the same way it affects the gray image.

- Fetal heart rate far to low or far to high:

  After acquisition the estimated fetal heart rate is displayed. If the value does not correspond to the estimations based on other diagnostic methods at all, the acquisition failed and has to be repeated.

- Asynchronous movement in different parts of the image:

  e.g., the left part of the image is contracting and the right part is expanding at the same time.

- The color does not fit the structures displayed in gray mode:

  The color is displayed above or below the actual vessel.

- Color “moves” through the image in a certain direction:

  This artefact is caused by a failure in detecting the heart rate due to low acquisition frame rate. Use higher acquisition frame rate for better result.

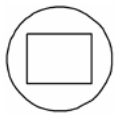
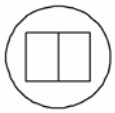
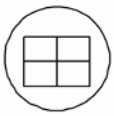
In all of the above cases the data set has to be discarded and the acquisition has to be repeated.

When is it not allowed to perform the STIC fetal cardio acquisition?

- severe fetal arrhythmia

Diagnoses made only by assessing this 3D/4D acquisition are not permitted. Every diagnostic finding has to be evaluated in 2D as well.

Menu item	Description
	Select the STIC menu item or press T key.
	Select a STIC user setting (e.g., Default). The preset values are loaded.

			Select the display format desired.

Note *When using **STIC CFM** (2D+CFM), **STIC PD** (2D+PD) or **STIC HD-Flow (2D+ HD-Flow)** adjustment of the Color settings is possible. The adjustment “Use 2D Color for STIC” is in User Settings* 'User Settings' *on page 16-8 possible. For further details, review: CFM Sub Menu* 'CFM Sub Menu' *on page 8-6 PD Sub Menu* 'PD Sub Menu' *on page 9-6 HD-Flow Sub Menu* 'HD-Flow Sub Menu' *on page 9-14*

Note *The selected format will be present in freeze mode after the acquisition is done. The **[Dual]** screen format key is only available in STIC Render mode!*

Before starting the acquisition, set the size of the volume box and the volume angle to contain all structures of the heart including the big vessels. However, the box should be small enough to contain only the heart, not the whole thorax.

Place the Volume box over the region of interest.



The trackball has two functions: position and size of the Volume box. The activated function is displayed in status bar area on the monitor.



Press the upper trackball key to change the function of the trackball from position to size or vice versa.

Change the size of the Volume box by moving the trackball.

Moving:

↑	decrease the box size in vertical direction
↓	increase the box size in vertical direction
→	increase the box size in horizontal direction
←	decrease the box size in horizontal direction

Note *Change the settings in order to get a 2D frame rate of at least 25 frames per second. Normally a frame rate between 25 and 30 frames per second is recommended.*

Menu item	Description
	Set the volume sweep angle by using the menu soft buttons.
	Select the Acquisition time.

Note *In order to archive a good result, try to adjust the volume box and the sweep angle to be as small as possible. The longer the acquisition time, the better the spatial resolution will be.*



Hold the transducer still and ask the patient not to move.

To start the acquisition press the **[Freeze]** key or the right trackball key (**Start** -> displayed in Status bar area on the monitor).



The volume acquisition starts and the acquired images are displayed.

Note *If CRI is enabled in 2D Mode, it is also used in STIC pre mode and during STIC acquisition. The settings (CRI value) are taken from the 2D settings. Use of CRI is indicated in the info block. It is also possible to combine CRI with STIC Color (CFM).*

Note *The user must be sure that no one of the participating persons (mother, fetus, user) moves during the acquisition. A movement of anyone will cause a failure of the acquisition. If the user recognizes a movement during the scan, the acquisition has to be cancelled with the [Exit Stop acquisition] key!*

Remarks:

- The color settings adjusted in CFM mode will be also used in STIC CFM mode.
- If the expected frame rate is too low for a good quality STIC acquisition (< 18MHz), following message appears on the screen:

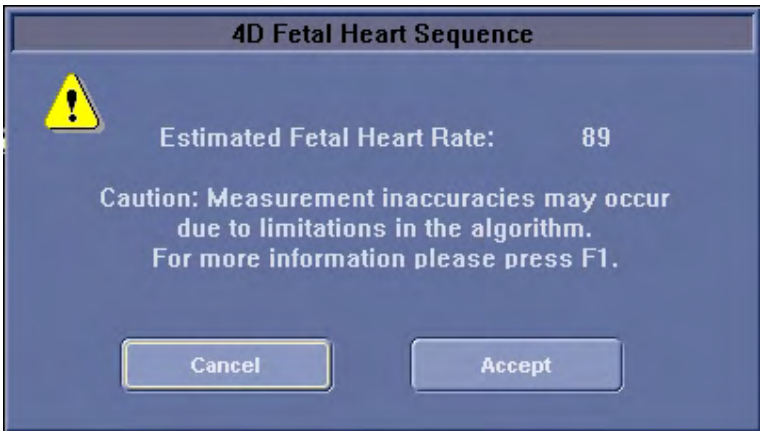
Frame rate is too low! Increase frame rate to optimize STIC results.

Despite the warning the acquisition can be started normally.

Wait till the system has completed the calculation.

10.2.6.2 After STIC Calculation

After the calculation, the Estimated Heart Rate is shown on the touchpanel. The previously selected format and the last acquired 4D sequence will be shown on the monitor.


4D Fetal Heart Sequence
Estimated Fetal Heart Rate: 89
Caution: Measurement inaccuracies may occur due to limitations in the algorithm.
For more information please press F1.
Cancel
Accept

Guidance and precautions for interpretation of STIC-images:

- Judge if the shown estimated heart rate is reasonable. Visually rule out phase errors and other failures of the acquisition before confirming the scan by touching the [Accept] key.
- Always adopt a critical attitude to images created in STIC mode.
- Be aware that any diagnostic conclusion must not be drawn from STIC-images alone, but have to be checked with other diagnostic procedures.
- If you are in doubt about a structure seen in STIC mode, consult the original 2D-images for clarification.
- Please note that the accuracy of measurements in STIC-images is limited and can be lower than measurements in B-images. **Note for Users in Germany:** Die Genauigkeit kann die KBV-Richtlinien unterschreiten.

In case the acquisition fails, press the [Cancel] button and perform the acquisition again. This will bring you to the pre-acquisition mode.

If you are content with the result press the [Accept] key. The “Vol. Cine” menu in freeze mode appears.

Upon [Accept] a certain number of volumes will be stored in the cine memory. The 4D Sequence can be reviewed volume by volume. 'Cines' *on page 10-76*

The 3D menu appears.

10.2.6.3 Measurements in the STIC-image

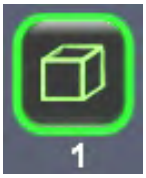
If the measurement function is activated in mode STIC, the yellow caution symbol appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.

For more information see 'Accuracy of measurements' *on page 12-20.*

This symbol will also be shown on the patient report (in the report header), if the performed STIC measurements are stored in the report. *For more information see* 'To view a Worksheet' *on page 13-5.*

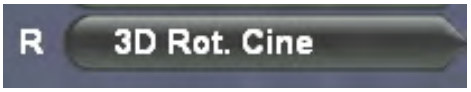
10.3 Visualization modes

10.3.1 Rendering mode

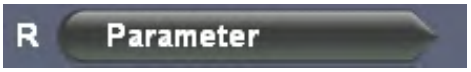


Select this item from the visualization modes menu or press 1 key to define Rendering as active visualization mode.

10.3.1.1 Main menu

Menu item	Description
	To switch the User program after acquisition start click the ***Set Rendering*** menu item or press the **U** key.
	'MagiCut' *on page 10-72*
	'3D Rotation Cine' *on page 10-78*
	Click this menu item or press **I** to set back all image planes to their initial state.'Principle of Sectional Image Analysis' *on page 10-84*
	Select this option to enable display of the ROI box.
	**Reset the render curve to its default position** This item resets the render start curve to its default (start) position. Curve adjustment is only possible in Dual and Quad view.
	Click this menu item or press **E** to make adjustments of the ROI. 'The Render Box' *on page 10-2*
	Click this menu item or press **S** to access the Rendering sub menu.

10.3.1.2 Sub menu

Menu item	Description
	The Probe Orientation menu appears and the system automatically switches to Quad-Screen display.
	Select the Render mode and algorithm.
	Select the desired Render Direction.

Menu item	Description
	'Thermal Indices' *on page 11-11*
	'Chroma Map' *on page 11-6*
	'Chroma Map' *on page 11-6*
	On/Off switch to show full or reduced Image Info parameter on screen.
	'Speckle Reduction Imaging (SRI II)' *on page 10-76*
	Adjust the contrast of the screen background from dark to bright.

10.3.1.3 Orientation help for 3D/4D data sets (Probe Orientation)

In order to simplify orientation in a 3D or 4D data set the user can activate the display of directions like cranial, caudal, left, right, anterior, posterior at the border of the 3D or 4D data set. The user has to select the position and the rotation of the probe in respect to the patient (or in obstetrics in respect to the fetus) at the time of acquisition. Then the actual display of the directions has to be activated manually. When the volume is rotated the orientations at the border of the image are adjusted accordingly. The display remains active until a new acquisition is performed or until it is turned off by the user. If the display is activated and the data set is saved, the probe orientation settings are stored in the data set. If the display is turned off however, probe orientation settings are not stored.

Start desired 3D Mode or 4D Mode Acquisition;

For more information see 'Getting Started' *on page 10-2.*



It is absolutely necessary to ensure that the Probe position exactly corresponds to Probe orientation adjustment.



Especial accuracy is required if selected acquisition Mode is 4D.

Moving the probe cause variations with probe orientation adjustment.

Select [Probe Orientation] item.

The Probe Orientation menu appears and the system automatically switches to Quad-Screen display:



The lower right quadrant displays the body pattern and the probe marker, independent of the selected visualization mode. Position of body pattern (body view and body rotation) and probe marker are stored in the 3D/4D user program.

The green point on the probe marker indicates the rotation of the probe (like GE-Logo on 2Dimage).

Menu item	Description
	Select the [Front] item to display the body pattern from front. The body pattern can be rotated in 45º angles.
	Select the [Back] item to display the body pattern from behind. The body pattern can be rotated in 45º angles.
	Select the [Top] item to display the body pattern from top view. The body pattern cannot be rotated.
	Select the [Bottom] item to display the body pattern from bottom view.

The body pattern cannot be rotated.



Press the upper trackball key to change between “Scan” and “No Function” or vice versa. If “Scan “ is selected, use the trackball to place the probe marker on the body pattern.

Right trackball key have the same function as the [Activate] key above.

10.3.1.4 Sub Menu

The [Sub Menu] item is available in all Volume acquisition menus (read- and write mode).



Select the [Sub Menu] item.



Note *The Render Direction items as well as some Sub Menu functions are not available in Static 3D Sectional Planes mode.*

Note *The functions Balance and Power Threshold are only available if a 3D+CFM or a 3D+PD image is acquired.*

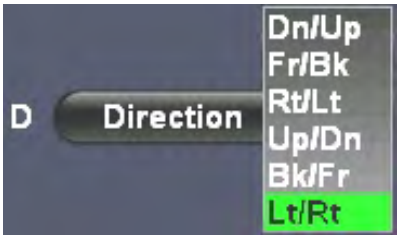
The 3D/4D Submenu contains different functions:

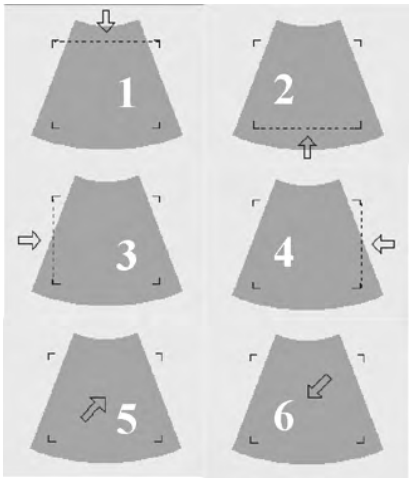
- Render View Direction
- 3D Gray Chroma Map
- 3D/4D Info
- Contrast
- Background
- Power Threshold

10.3.1.5 Render View Direction

The 3D render box determines the ROI (region of interest) for the 3D calculation and determines the direction of the view through the volume block. The adjustment of the render box is done with help of the 3 orthogonal planes A, B and C, each dividing the box in the middle. *For more information see* 'The Render Box' *on page 10-2.*

Select the desired Render Direction.





Explanation for the Render Box direction Up/Down:

Plane A: The viewing direction is from top to bottom in plane C.

Plane B: The viewing direction is from top to bottom in plane B.

Plane C: The viewing direction is normal on plane C (bird's eye view).

The green line of the rendering box in A- and B-plane symbolizes the direction of the view and the border for starting the analysis.

Note *The Render View Direction keys are not available in Static 3D Sectional Planes mode.*

10.3.1.6 3D Gray Chroma Map

Operation review: 3D Gray Map '3D Gray Map' *on page 11-4*

10.3.1.7 Image Info



On/Off switch to show full or reduced Image Info parameter on screen.

On (full): Off (reduced):

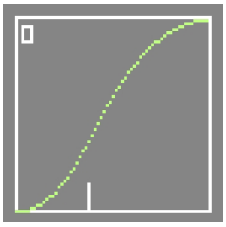
includes 3D/4D, 2D & CFM Mode 3D/4D Info only



Note *If the volume was compressed using lossy image f, a yellow Wxx", where xx stands for the compression quality (e.g. 90) is displayed beneath the type line (e.g. 3D Static)*

Note *Review: SonoView Configuration* 'SonoView Configuration' *on page 16-30*

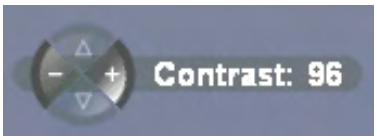
10.3.1.8 Contrast



Graphic display on screen:

This graphic is provided only for the 3D/4D image.

Horizontal axis: gray values from 0 to 255 Vertical axis : brightness from black to white

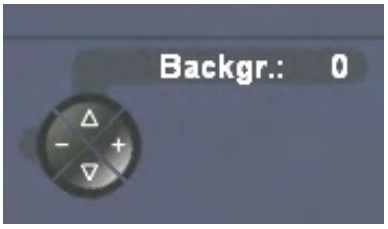


1. Set the contrast of the bending.

Note *The settings require an alert observation of the influence on the 3D-image! These keys are not available in Static 3D Sectional Planes mode.*

10.3.1.9 Background

With the Background select of the screen brightness function the contrast between screen background and B-image is set. This function is only of significance in B-scan, when a part of the screen background is visible.



Adjust the contrast of the screen background from dark to bright.

Note *This key is not available in Static 3D Sectional Planes mode.*

10.3.1.10 Power Threshold

This function eliminates low color noise of motion artifact signals in the sectional slices as well as in the rendered 3D image.



A lower number cuts off fewer signals than a higher number.

Note *This key is only available if a 3D+CFM or a 3D+PD image is acquired.*

Condition to activate 3D Image Rendering:

1. A “Static 3D Sectional Planes” volume scan is performed and in read mode.

10.3.1.11 Render Parameter – Basic Mode and Render Algorithm

For a good 3D image please note the following application hints:

1. Surface Modes:

Adjust the render box in a way to have free sight from the render-start-area to the surface to be displayed. Surface imaging requires hypoechoic structures (e.g., liquids) between render-start-area and the surface to be displayed. With the control [TH. low] echo structures adjacent to the surface can be "cut off" if their gray values are much lower than the gray values of the surface structures. Always cut out signal noise with the control [TH. Low].

2. Transparent Modes:

For a good 3D impression transparent-mode-images need a certain number of different views, which are shown in a rotating cine sequence. The increment/step angle should be about 5 degree. The 3D impression results from the different movements of diverse structures.



1. Select the [Parameter] item from the sub menu. The Render Mode menu appears.



2. Select the Basic Mode.

3. Select the Render Algorithm (e.g.: Surface and Transp.: X-ray).

Example: S./Xray = Surface and X-Ray.

For Example:

To produce a better smoothed surface by mixing surface smooth and light mode.



Return to the 3D Render menu.

10.3.1.12 Gray Render Mode

In Gray Rendering Mode only the gray information of the data set is used, even if a Color Volume image is displayed. In case of a data set without color information, this mode is automatically activated.

1. Activate Gray Render Mode (if not active).



2. Select the render algorithm desired.

Note *Always select 2 modes!*

Surface Texture: Texture:

A surface will be displayed in "texture" mode. The gray values of the surface are identical with the gray values of the original scan.

Light: Light	A surface will be displayed in "light" mode. Structures near to the viewer are displayed bright; structures far from the viewer are darker.
Application:	The surface to be displayed has to be surrounded by hypoechoic structures (e.g. liquids).

Surface Smooth: Texture:

The surface is displayed in a smoothed "texture" mode The gray values of the surface are identical with the gray values of the original scan.

Gradient Light:	The surface will be displayed as if being illuminated from a spot light source.
Application:	The surface to be displayed has to be surrounded by hypoechoic structures (e.g. liquids).

Maximum Mode:	The maximum gray values of the ROI are displayed.
Application:	Representation of bony structures.

Minimum Mode:	The minimum gray values of the ROI are displayed.
Application:	Representation of vessels and hollow structures.

X-Ray Mode:	Representation of all gray values within the ROI.
Application:	Tissue block with tumor or similar.

The software module allows selection of 2 modes which are simultaneously calculated. Always the actual selected mode is displayed with 100%. With the [Mix]-key one can mix between the chosen modes. Selection itself is liberal, except the Light mode, which combines only with Surface display.

10.3.1.13 Threshold Control in Gray Render Mode

Function of the threshold values (Surface Mode only)

In the event Surface mode is selected, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

Threshold Low (Reject):

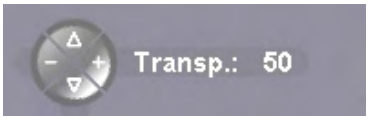


Normally this threshold always has to be adjusted for a good appearance of the 3D surface image.

By changing the [TH.low] all echoes below the level are enhanced in pink color for a certain interval.

Application: With this function small echoes or noise are removed, to have a "clear sight" from the start boarder of the render box to the desired Surface.

10.3.1.14 Transparency in Gray Render Mode



small number = low transparency. A higher number makes the gray scale information more transparent.

Note *The control for the Transparency is found in the status area.*

10.3.1.15 Color Render Mode

In Color Rendering color information of Color or Power-Doppler signal can be used for the 3D display.



1. Activate Color Render Mode (if not active).



2. Select the render algorithm desired.

Note *Always select 2 modes!*

Surface Mode:

Surface-display of color information of blood flows

Light Mode: Light:

A surface will be displayed in "light" mode. Structures close to viewer are displayed bright; structures distant to the viewer are darker.

Maximum Mode:	The maximum gray values of the ROI are displayed.
Application:	Representation of all vessels in the ROI. 3D impression can be observed with rotation of the display.

X-Ray Mode:

All color values in the ROI are used for the calculation and are averaged (impression will be an X-Ray image)

The software module allows selection from 2 modes which are simultaneously calculated. Selection itself is liberal, except with the Light mode which combines only with Surface display.

The following Rendering combinations are possible:

- Surface + Light
- Surface + Maximum
- Surface + X-Ray

In case Surface mode is selected, it will normally be necessary to adjust the low and the high threshold for the border recognition of the surface. The threshold values do not apply for the Transparent modes!

10.3.1.16 Threshold Control in Color Render Mode

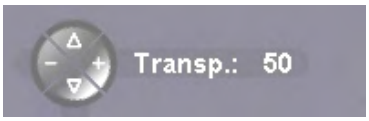
Threshold Low (Reject):



Normally this threshold always has to be adjusted for a good appearance of the 3D surface image.

By changing the [Treshold], all echoes below the threshold level are enhanced in pink color for a certain interval. All the color values below this level (pink in the B Scan) will be disregarded for the calculation of the surface.

10.3.1.17 Transparency in Color Render Mode



small number = low transparency. A higher number makes the gray scale information more transparent.

Note *The control for the Transparency is found in the status area.*



If a 3D+CFM or a 3D+PD image is acquired, the controls for the [Balance] and the [Power Threshold] are displayed after selecting the [Sub Menu] item.

For more information see 'Balance' *on page 8-13.*

For more information see 'Power Threshold' *on page 10-33.*

10.3.1.18 Glass Body Render Mode

In Glass Body Render Mode the color and the gray information are processed into a 3D/PD or 3D/CFM volume.



1. Activate Glass Body Render Mode (if not active).



2. Select the render algorithm desired.

Note *Always select 2 modes!*

The following Rendering combinations are possible:

Gray mode

- Transp. Texture
- Transp. Texture
- Transp. Max
- Transp. Max

Color mode

- Surface
- Transp. Max
- Surface
- Transp. Max

In case Surface mode is selected, it will normally be necessary to adjust the low threshold for the border recognition of the surface. These threshold values do not apply for the Transparent modes!

Adjustment of Threshold low and Transparency review Color Render mode:

- Threshold low
- Transparency

Adjustment of Balance and Power Threshold review Sub Menus:

- Balance
- Power Threshold

10.3.1.19 Measurements in Rendered Image

It is possible to measure distance and area (generic and calc) also in the rendered image.

If the measurement function is activated in mode Render, the yellow caution symbol  appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.



For more information see 'Accuracy of measurements' *on page 12-20.*

This symbol will also be shown on the patient report (in the report header), if the performed Render Mode measurements are stored in the report. *For more information see* 'To view a Worksheet' *on page 13-5.*

10.3.1.20 General Advices to Obtain Good Rendered 3D Images

B MODE

- Poor quality of the volume scan will lead to a poor quality 3D image.
- For a good 3D image quality, adjust high contrast in 2D mode of the interesting structures before starting the volume scan.
- Only the ultrasound data within the ROI (render box) will be calculated and displayed.
- The correct placement of the ROI is essential for a good result, because the ROI determines the view onto the interesting object.
- **Surface Mode**: note that the surface of interest has to be surrounded by hypoechoic structures; otherwise the system is unable to define the surface. With the function "THRESHOLD" echo structures adjacent to the surface can be "cut off" if their gray values are much lower than the gray values of the surface structures.
- **Minimum Mode**: note that the interesting objects (vessels, cysts) should be surrounded by hyperechoic structures. Avoid dark areas (shadows caused by attenuation, dark tissue presentation) within the ROI, otherwise large parts of 3D images will be displayed dark.
- **Maximum Mode**: avoid bright artifact echoes within the ROI, otherwise these artifacts are displayed in the 3D images.

- **X-Ray Mode**: note that all gray values within the ROI are displayed. Therefore, in order to enlarge the contrast of the structures within the ROI, the depth of the ROI should be adjusted as low as allowable.

COLOR MODE:

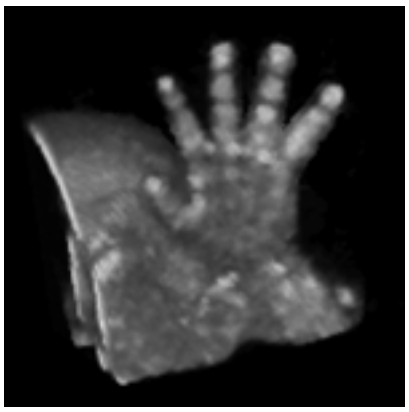
- Poor quality of the Color image in 2D mode will lead to poor image quality in 3D color image.
- In Power-Doppler mode (control "PD") a pure flow display without directional coding is given.
- Use small VOL box and small sweep angle to reduce acquisition time.
- Smoothing Filter (Rise and Fall in 2D image) leads to smoother flow and a good color 3D display of vessels (e.g., filtering of high pulsatile vessels). Disadvantage: The higher the filter setting, the longer the acquisition time.
- **Surface Mode:** Displays the surface of the vessels (color signals) within the tissue volume.

Note *If the Mix control is adjusted to 100% color, the gray scale tissue information becomes transparent.*

10.3.1.21 Examples of Rendered Images

Surface mode: gray rendering

Fetal hand



Fetal face and umbilical cord

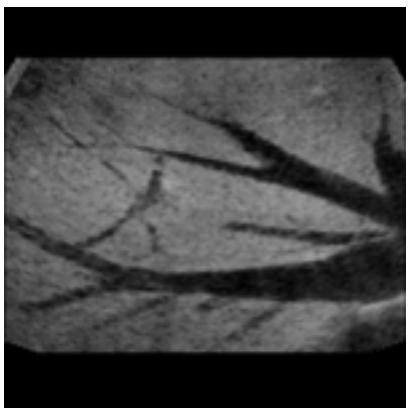


Transparent mode: gray rendering

Maximum mode: fetal skeleton



Minimum mode: liver vessels



10.3.2 Sectional Planes



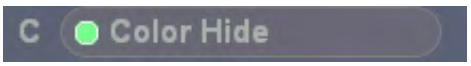
Select this item from the visualization modes menu or press 2 key to define Sectional Planes as active visualization mode.

10.3.2.1 Main menu

Menu item	Description
	'Niche Display Mode' *on page 10-65*
	'VCI Static' *on page 10-67*
	'SonoVCAD labor' *on page 10-68*
	'Orientation Help Graphic' *on page 10-75*
	Click this menu item or press I to set back all image planes to their initial state.'Principle of Sectional Image Analysis' *on page 10-84*
	Click this menu item or press **S** to access the Sectional Planes sub menu.

10.3.2.2 Sub menu

See 'Rendering mode' *on page 10-28* for a complete list of items in the 3D/4D submenu.

	On/Off switch to show an acquired 3D+CFM or 3D+PD image with or without the color information.

10.3.2.3 Automatic Optimization in Volume Mode

This function will optimize the contrast resolution of the sectional planes (A, B and C) according to the histogram of the scan area. However, the rendered image is NOT affected. The primary result is a value for the left and right endpoint of the actual histogram.



Pressing the **[auto]** key causes automatic optimization of the gray scale to enhance the contrast resolution of the sectional planes (A, B and C). When the key is pressed again, the optimization according to the histogram will be updated and remain active.

Press the **[auto]** key twice to switch off the Automatic Optimization.

Remarks:

- When the Automatic Optimization function is active, the [auto] key is brightly illuminated.
- The rendered image is NOT affected (not optimized).

10.3.2.4 Choosing a Reference Image



Press the left trackball key [Ref.Image] repeatedly to choose the reference image. Choosing a reference image automatically determines the control functions of the rotary controls and trackball for the liberal adjustment of a sectional plane.

With simultaneous display of the sectional planes A, B and C (3-section mode) the one chosen for reference is marked by a yellow letter (e.g., **A**):

If a single sectional plane A, B or C is displayed (full-screen mode, arbitrary plane mode), this is the reference image. The reference image may be changed.

10.3.2.5 Image Position

By this function the position of a reference image A, B or C in relation to the display field is determined.



Press the upper trackball key to change the function from axis position to image position.



By means of the trackball the reference image is shifted and positioned in X- and Y-direction, respectively. The center of rotation remains fixed, only the volume is shifted.

10.3.2.6 Image Magnifier

By this function the aspect ratio of a reference image A, B or C relative to the display field is determined.



By means of this switch the sectional images (A, B and C) will be magnified from the center of rotation.

10.3.3 SonoAVC follicle

Note *SonoAVC follicle is optional. Please contact your local sales representative for further information.*

Note *To facilitate manipulation of SonoAVC follicle data sets in 4DView (up from version 7.0) plug the 4DView dongle into one of Voluson® i's USB ports. The dongle is then automatically programmed.*

This feature helps to detect low echogenic objects (eg. follicles) in an organ (eg. ovary) and analyzes their shape and volume. From the calculated volume of the object an average diameter will be calculated. All objects detected that way will be listed according to size.



Click the SonoAVC follicle button or press 3 in Static 3D mode to evoke SonoAVC follicle pre-mode.

10.3.3.1 Pre-Mode



Adjust the ROI to get a good view on the low echogenic objects using techniques described in 'The Render Box' *on page 10-2* and press either the Left Ovary or the Right Ovary button, depending on the acquired image. After a few moments of calculation the Voluson® i advances to SonoAVC follicle main mode.

10.3.3.2 Main Mode



10.3.3.3 Table of low echogenic objects

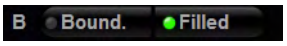
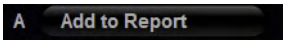
The calculation results are displayed in the top right corner. The objects are listed according to size. All different objects are colorcoded i.e. the colour surrounding the number of the object also denotes the object on the image. If the mousecursor hovers over a specific item on the list the respective object in the image is highlighted and vice versa. The color of the object is bound to its postion on the list. The biggest object will always be displayed in red, the second biggest one in green and so on.

Nr	d(V) [mm]	mn. d [mm]	V [cm³]
1	16.9	17.8	2.54
2	14.0	14.9	1.45
3	14.0	15.2	1.43
4	13.8	14.4	1.38
5	13.4	14.5	1.27
6	13.3	14.1	1.23
7	12.8	14.4	1.10
8	12.4	13.1	0.99
9	11.0	11.6	0.70
10	10.7	11.2	0.64
11	10.1	10.6	0.54
12	7.9	9.1	0.26
13	4.8	5.0	0.06

d (V)	Diameter, calculated as if the object was a perfect sphere
mn. d	Average value of the x-axis, y-axis and z-axis
V	Volume of the object

10.3.3.4 Main menu

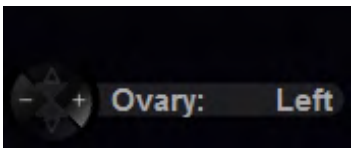
Menu item	Description
E Edit ROI	Click this menu item or press E to go back to Pre-Mode and make adjustments of the ROI.
I Init	Click this menu item or press I to set back all image planes to their initial state.

Menu item	Description
	• Select the Bound. option to highlight the segments by displaying boundaries as a colored line. • Select the Filled option to highlight the segments by filling the area of the segment with color.
	Click this menu item or press A to add the list of volumes to the GYN report. 'Gynecology Calculations' *on page 13-56*
	Click this menu item or press C to revert the auto generated volumes to their initial state.
	Click this menu item or press R to Redo the last Undo operation.
	Click this menu item or press U to Undo the last Cut/Merge operation.
	Select this option to enable display of the ROI box.

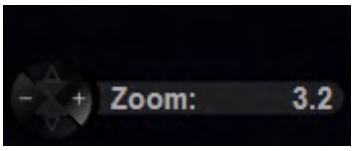
10.3.3.5 Image parameters



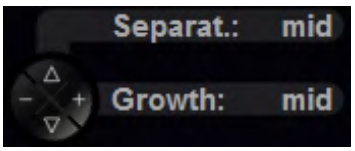
Change the Threshold for inversion rendering using the +/- menu soft buttons. This parameter does not influence the SonoAVC follicle calculation.



Define wether the current volume was taken from the left or right ovary using the +/- menu soft buttons.



Adjust the zoom level using the +/- menu soft buttons.

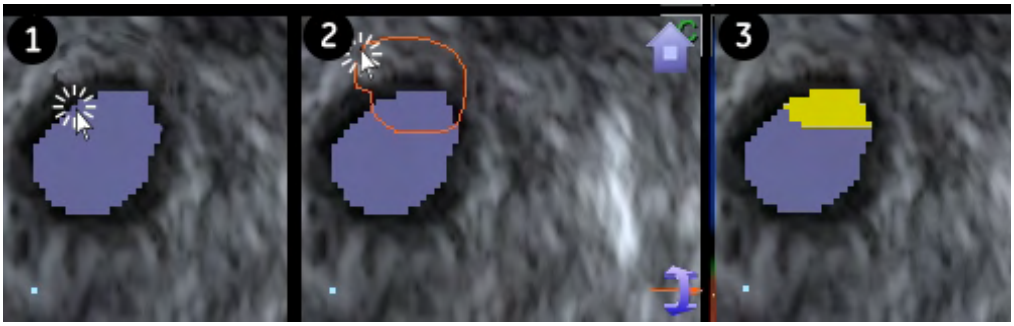


Separation is controlling a parameter of the segmentation algorithm that defines an initial threshold to separate objects. Increasing this parameter will prevent objects from being

identified as multiple objects (e.g. when there is noise within the object), but might prevent small objects from being found correctly.

Growth is controlling a parameter in the segmentation algorithm that defines the final shape of the objects found. Increasing this parameter will allow the objects to fit tighter to the visible boundary. A value too large might cause the objects to grow over the boundary and cover areas no longer part of the objects of interest.

10.3.3.6 Editing auto-generated volumes



To cut a volume:



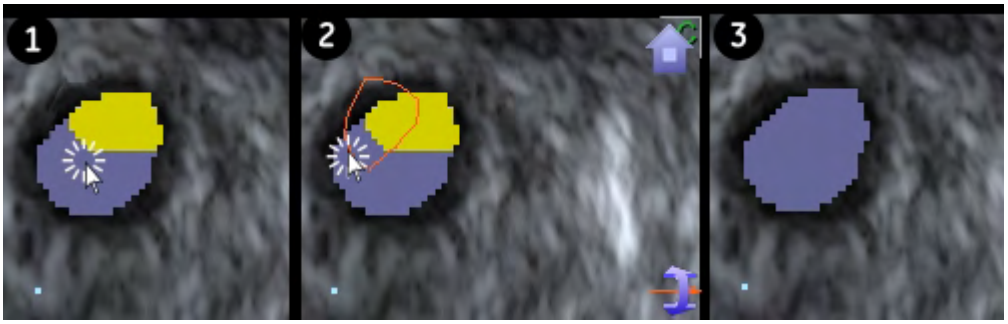
1. Press the left trackball key to start drawing a path along the area you want to cut out.
2. Press again to set the path's endpoint. If the path is not closed, the software will connect the start and end point with a straight line.
3. The area within the path is cut out and inserted as new volume.

To add or remove volumes:



- Point the cursor to an auto-generated volume and press the upper trackball key to remove it.
- Point the cursor to a low echogenic object in the image, which was not counted by the algorithm, and press the upper trackball key to add it to the list.

To merge volumes:





1. Press the right trackball key to start drawing a path that encloses or passes the volumes you want to merge.
2. Press again to set the path's endpoint. If the path is not closed, the software will connect the start and end point with a straight line.
3. All volumes along the path now appear as a single segment.

10.3.3.7 Undo operations

Use the Undo / Redo / Undo All buttons in the main menu to correct your recent editing actions.

10.3.4 VOCAL II*

Note *VOCAL II is optional. Please contact your local sales representative for further information.*



Select this item from the visualization modes menu or press 4 key to define VOCAL II as active visualization mode.

10.3.4.1 Introduction

VOCAL II - Imaging program opens up completely new possibilities in cancer diagnosis, therapy planning and follow-up therapy control. It offers different functions:

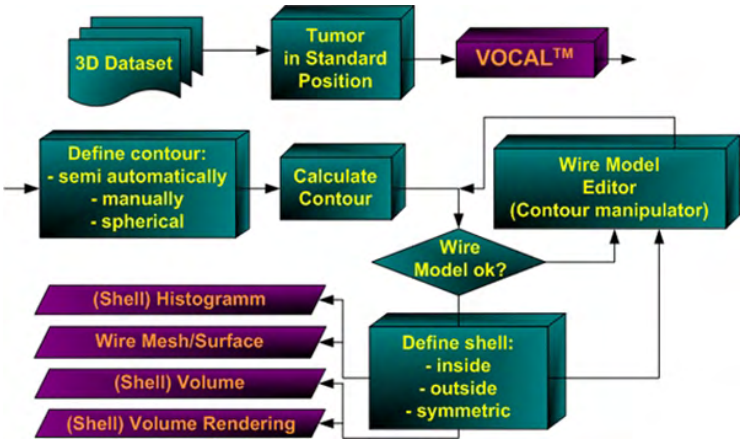
- Manual Contour detection of structures (such as tumor lesion, cyst, prostate, etc.) and subsequent volume calculation. The accuracy of the process can be visually controlled by the examiner in multi-planar display.
- Construction of a virtual shell around the contour of the lesion. The wall thickness of the shell can be defined. The shell can be imagined as a layer of tissue around the lesion, where the tumor vascularization takes place.

The follow-up control of tumor volume and vascularization delivers information on the proper dose of medication or radiation and is therefore a measure for the success of treatment. After definition of a contour in 3D space a wide range of functionality is given:

- definition of a shell contour
- visualization of a (shell) contour as a surface or wire mesh
- volume calculation of a (shell) contour
- histogram calculation of ultrasound tissue inside a (shell) contour
- visualization of ultrasound tissue inside a (shell) contour as a rendered image
- niche presentation of contour and slices
- cine rotation calculation

The basic idea behind VOCAL II is the combination of 3D ultrasound tissue (presented as voxels) and the geometric information of surfaces in a 3D dataset. The main interest of VOCAL II is the volume calculation of tumors or lesions.

The principle operation steps are given in this diagram.



10.3.4.2 Definitions

Definition of the Surface Geometry

The *Surface Geometry* is defined by rotation of an image plane about a fixed axis (main contour axis) and the definition of 2D contours in each plane. The 2D contours can be defined semi-automatically (Magic Finger), manually or by an automatic sphere. The rotation step for each contour plane depends on the VOCAL Mode and on the selected rotation steps.

The *Surface Geometry* is defined by 3D triangularization of the 2D contours, meaning each point of the 2D contour in plane N is connected via a triangle mesh to corresponding points in plane N-1 and plane N+1.

Definition of a Shell Contour (Geometry)

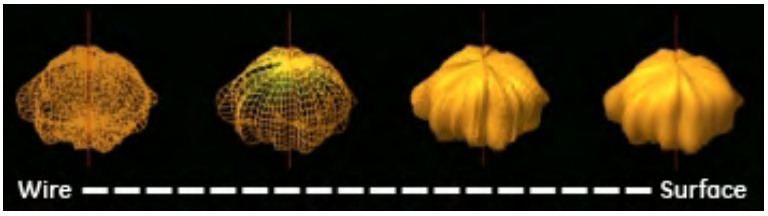
The basic idea of a *Shell Contour* is, to define a “thickness”’ of the “reference”’ surface geometry.

The “’parallel” contours shown in the image define the “parallel” surface geometry (describing the shell). The “parallel” contours are either defined symmetrically to the reference contour or limited to one direction, inside or outside. The *Shell Geometry* consists of one outside and one inside surface and therefore it is possible to distinguish between points enclosed by the shell geometry and points outside of it. A *Shell Contour* represents all points enclosed by the inner and outer surface geometry. If no *Shell Contour* is defined explicitly, the *Shell Geometry* consists of the reference surface (outside surface) and an inner point (the inside surface being degenerated).

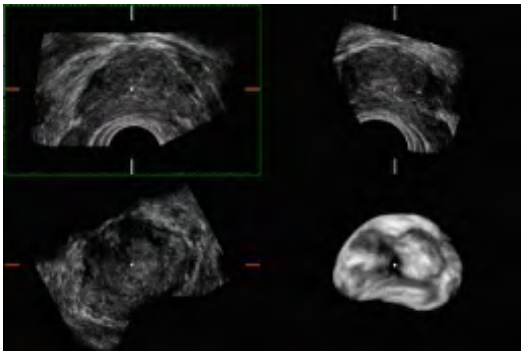
Display of a Shell Geometry (contour rendering)

The shell geometry can be visualized as “Skin” or “Wire Mesh”.

The image shows the different visualization techniques. VOCAL shows a surface Mesh.



Volume Rendered Image of a Shell Contour



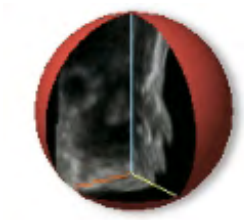
The shell contour is used to define which voxels in the 3D ultrasound dataset are parts of the shell geometry and which are outside. Voxels outside the shell contour are not displayed in the Volume Rendered image.

(Shell) Volume Calculation

The (shell) volume is defined as the difference between the volume defined by the outer surface

(of the shell geometry) and the volume defined by the inner surface (of the shell geometry).

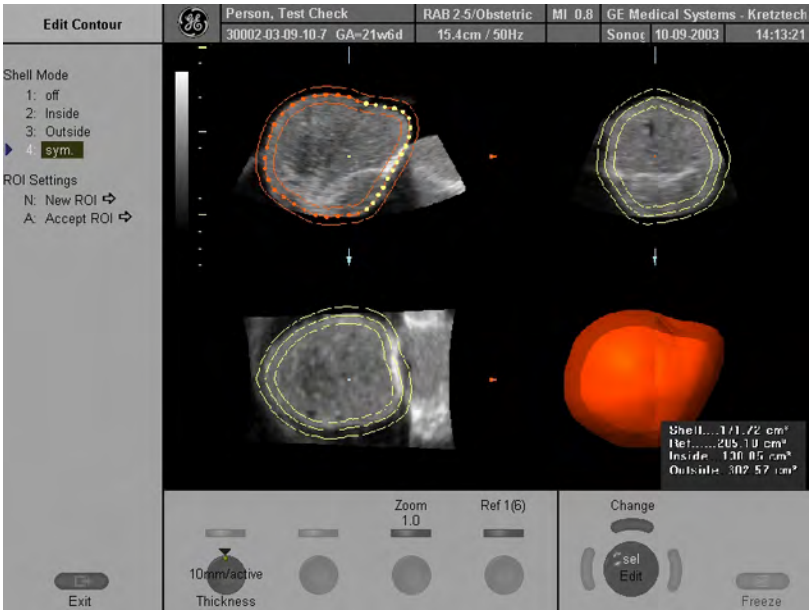
(Shell) Niche presentation



The niche presentation allows the visualization of slices and the shell contour in one image. The presentation gives a 3D overview about the orientation of the slices and the shell contour.

Summarized Definitions

Surface Geometry:	A closed triangle mesh of 3D contour points.
Shell Geometry:	A defined inner and outer surface geometry.
Shell Contour:	Points inside the inner and outer surface of the shell geometry.
Shell:	Generic term of shell contour and shell geometry.



Screenshot of a shell contour

10.3.4.3 VOCAL -Define a new Contour

Operation:

The “VOCAL Modes” menu is shown in the menu area of the monitor.



Select the desired contour generation mode.

Note *If desired, change the “VOCAL Settings” of the chosen VOCAL Generation Mode.*



To start defining a new contour, select the [Start] item.

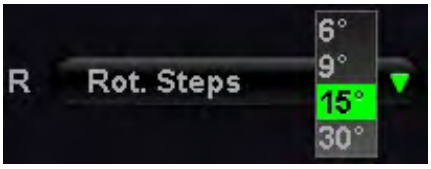
10.3.4.4 VOCAL Settings

Selection of Rotation Steps

The “Rotation Steps” define, how many contours are generated. The angle of the rotation steps is a major influence on the level of detail.

For example:

An angle setting of [30º] means that after the fist trace has been done, the volume data set is rotated 30º and then the next trace has to be performed, and so on. With rotation step [30º], 6 traces have to be done.

	6º = 30 traces
	9º = 20 traces
	15º = 12 traces
	30º = 6 traces

Tips and Tricks:

For symmetrical, roundish structures a 30º rotation step will work just fine. For irregular shapes, select 15º and below for manual trace.

Selection of the Reference image



The selection of the reference image defines the image plane(s) to generate the contours. Press the left trackball key repeatedly to select the reference image.

To generate the contours, the reference image is rotated via the:

- vertical axis (for reference image A or B) or the
- horizontal axis (for reference image C).

The center of rotation is indicated by a dashed red line.



Selection of the Zoom level The level of magnification can be manipulated via the menu soft buttons.

Start defining the contour



After selecting the [Start] item, the “VOCAL Generation” menu of the selected contour generation mode appears.

10.3.4.5 Selection of a VOCAL Generation Mode

The main contour axis should lie in the center of the 3D lesion. (The 3D object should be centered with respect to the rotation axis.) All defined contours (in different planes) cross the main contour axis at the position of the green arrows. If not, change the position of this line by using the trackball.

There are two ways to generate a (shell) contour:

- Manual - Trace
- Automatic - Sphere

10.3.4.6 Manual - Trace

This function allows you to manually outline any lesion by means of the trackball. The number of manually generated contours depends on the selected rotation step.



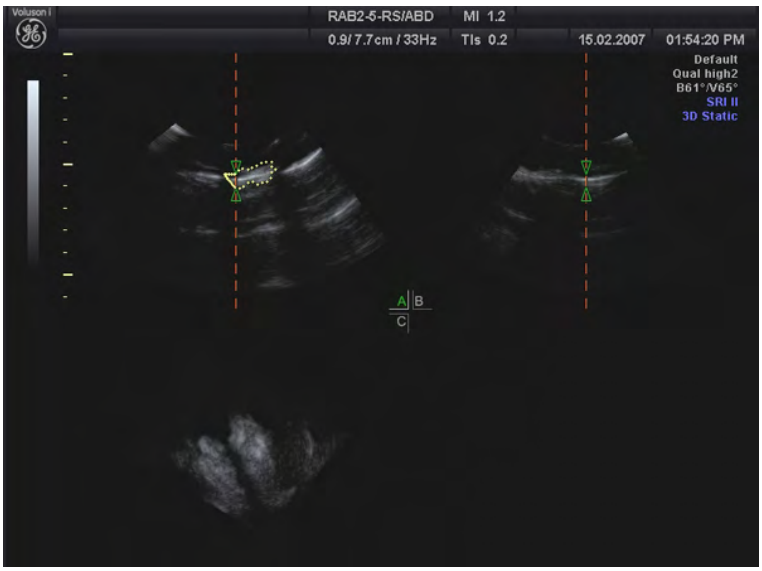
1. In the VOCAL menu, select the Trace contour mode item.

2. To define the contour, select the [Start] item.



3. Position the cursor for starting the contour with the trackball and press the right or left trackball key [Set]. Outline the first contour by means of the trackball. To fix the contour, press the right or left trackball key [Set] again.

The two green arrows of the contour points are automatically positioned on the main contour axis. The outlined contour is only valid if the rotation axis is crossed exactly twice.





4. Select the next image plane by means of the menu soft buttons or select the Next item in the menu area.

The contour is copied to the next image plane and can be redefined by drawing a new contour. Every time you start to outline a contour, the new contour in this image plane replaces the old one.

5. Trace all remaining contours in the same manner.



6. After you have defined the contours in all image planes, select [Done].

The result is displayed on the monitor and the VOCAL Edit menu appears again.

10.3.4.7 Automatic - Sphere

This computer assisted contour mode function is only useful if you want to outline the surface of a sphere. Using this function a sphere round the main contour axis is generated within the two green arrows. The number of generated contours depends on the selected rotation step.



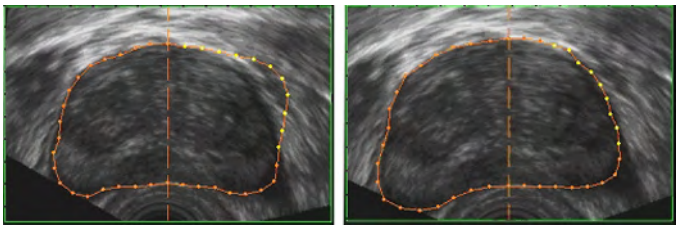
1. In the VOCAL menu, select the Sphere] contour mode.

2. To start defining the contour, select the [Start] item. The result is displayed on the monitor.

10.3.4.8 VOCAL - Edit

The monitor screen appears as follows:

- The reference image shows the first generated contour, outlined with red and yellow dots.
- In the orthogonal slices the intersection curves between the shell geometry and the different image planes are outlined as a yellow contour.
- The shell geometry is visualized in the lower right quadrant.



The “VOCAL Edit Contour” menu appears in the menu area on the monitor.



In the “VOCAL Edit Contour” menu:

1. the contours can be manipulated; review: Modifying a Contour
2. a shell contour is generated; review: Defining a Shell contour



By pressing this button, you dismiss the current contour and return to the VOCAL - Define Contour menu.

10.3.4.9 Modifying a Contour

When moving the trackball, the dots change to yellow according to the position of the cursor. The closer the icursor is positioned to the contour, the lesser dots are highlighted yellow.



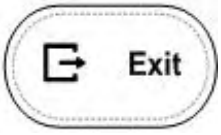
1. Press the upper trackball key and move the yellow dots by using the trackball. Press the upper trackball key again to store the modified contour.

2. Repeat these steps if necessary. All relevant results (shell contour, volume etc.) are updated automatically.



3. Select the next image plane by using the menu soft buttons and modify the contour for this plane.

4. Select the desired Shell mode.



5. After you have modified the contours in the selected image planes, press the Exit key.

The shell contour is accepted and stored. The VOCAL - Static 3D menu appears.

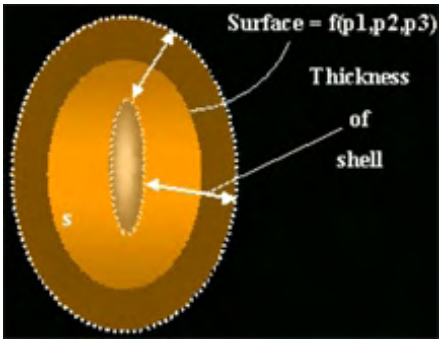
10.3.4.10 Defining a Shell contour (shell geometry)



Shell [OFF]

- The outside surface is equal to the generated contours (reference surface geometry).
- The inside surface is represented by an inner point (the inside surface is degenerated).

Selection of other *Shell* states mean:



Shell [Inside]

- The outside surface is equal to the reference surface geometry.
- The inside surface is the surface geometry of the inner 'parallel' contours with *distance Shell Thickness* in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (the inside surface is degenerated). (A contour is only valid if the rotation axis is crossed exactly twice.)

Shell [Outside]

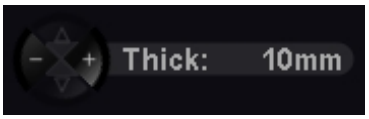
- The outside surface is the surface geometry of the outer 'parallel' contours with *distance Shell Thickness* in mm.
- The inside surface is equal to the reference surface geometry.

Shell [Sym.] (symmetric)

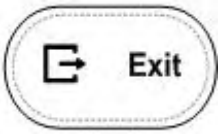
- The outside surface is the surface geometry of the outer 'parallel' contours with *half distance Shell Thickness* in mm.

- The inside surface is the surface geometry of the inner 'parallel' contours with *half distance Shell Thickness* in mm.

If one of the inside contours is not valid, the inside surface is represented by an inner point (the inside surface is degenerated). (A contour is only valid if the rotation axis is crossed exactly twice.)



The thickness of the shell can be adjusted by using the menu soft buttons.



The shell contour is accepted and stored. The VOCAL - Static 3D menu appears.



The shell contour is not accepted and you return to the "VOCAL Modes" menu, where you can define a new contour.

Of course, only valid reference contours generate a valid shell contour.

10.3.4.11 Display of the (Shell) Volume

The (shell) volume is defined as the difference between the volume defined by the outer surface (of the shell geometry) and the volume defined by the inner surface (of the shell geometry). A degenerated surface is symbolized in the display with xxxxx.

The Volume is displayed on the monitor in the lower right quadrant:

Shell Vref. Inside Outside

xxx.xx cm³ xxx.xx cm³ xxx.xx cm³ xxx.xx cm³

If the reference surface geometry is not valid, all volumes are invalid and displayed with xxxxx.

10.3.4.12 VOCAL - Static 3D

In this menu several display modes can be selected. You will enter this menu after accepting the shell contour.



Press the Exit key. The defined (shell) contour is accepted, stored and results are displayed.

The following menu appears on the monitor's menu area.

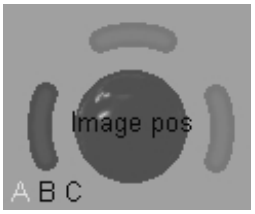




Readjust the defined contour.

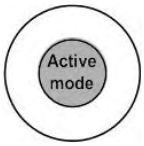


Define a new contour.

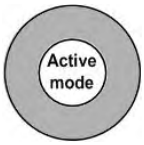


The Active mode button and the trackball are assigned to the selected reference image for adjusting the position, magnification and rotation of the shell image.

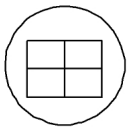
To rotate and shift the reference- and VOCAL 3D image



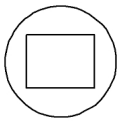
Press the Active mode button to toggle between X Rotation, Y Rotation, Z Rotation and Parallel Shift.



Turn the Active mode wheel in order to perform the previously selected image orientation action.



Depending on the “Render Mode” setting, the skin (of the shell contour) or the rendered volume image within the shell contour is displayed in the lower right quadrant.



Depending on the “Render Mode” setting, the skin (of the shell contour) or the rendered volume image within the shell contour is displayed in full size format.



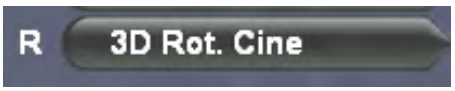
Apply Render Settings from the User Program to the VOCAL Surface.



The “Render Mode” menu appears in the menu area.



Edit the VOCAL Surface in MagiCut Mode. 'MagiCut' *on page 10-72*



Create a 3D Rotation Cine from the VOCAL Surface. '3D Rotation Cine' *on page 10-78*



The surface of the (shell) contour is cut up and the slices of the 3D image and the surface of the (shell) contour is displayed in one image. Touch exit the “VOCAL Niche” menu, touch the [Niche] key again.



The touchpanel shows the calculated Threshold volume (according to the monitor display).



After volume calculation via the VOCAL II - Imaging program, it is possible to display an automatically calculated (Color Angio) Histogram of the volume.

10.3.4.13 Render Mode and Display of the Shell Geometry



1. Select the [Rendering] item.

The “Render Mode” menu appears in the menu area.



2. Select the desired Render Mode (e.g., Artific. Surface). 3. Select the display of the Shell Geometry among [Skin] or [Wiremesh]. 4. Select the [Surface Color] item to change the color of the Shell Geometry.

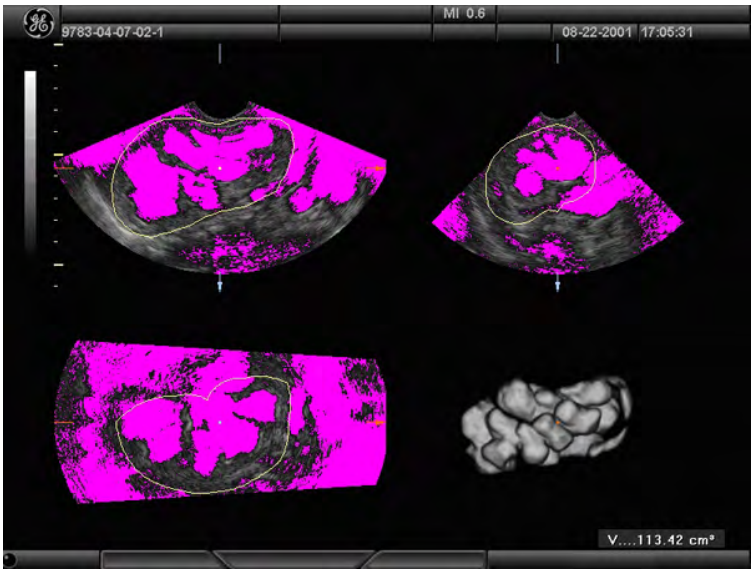
10.3.4.14 Threshold Volume

After volume calculation via the VOCAL II- Imaging program (**V**irtual **O**rgan **C**omputer-aided **A**na**L**ysis), it is possible to display an automatically calculated Threshold volume.



Select the [Threshold Volume] item from the Vocal menu.

The touchpanel shows the calculated Threshold volume (according to the monitor display).



Monitor display (e.g., Hydronephrosis)



Adjust the threshold value. A small number cuts off fewer signals than a higher number.

10.3.4.15 Vocal Measurement Display

The layout and position of the display of the VOCAL results has to be the same as selected in 'Accuracy of measurements' *on page 12-20* . If result position is mode dependent the settings for 2D apply to VOCAL as well.

If the measurement function is activated in mode VOCAL, the yellow caution symbol appears on the screen. This symbol reminds the user that UNINTENDED USE of this feature could lead to measurement inaccuracy.

For more information see 'Accuracy of measurements' *on page 12-20.*

This symbol will also be shown on the patient report (in the report header), if the performed VOCAL measurements are stored in the report. *For more information see* 'To view a Worksheet' *on page 13-5.*

The same applies for the Threshold Volume result window.

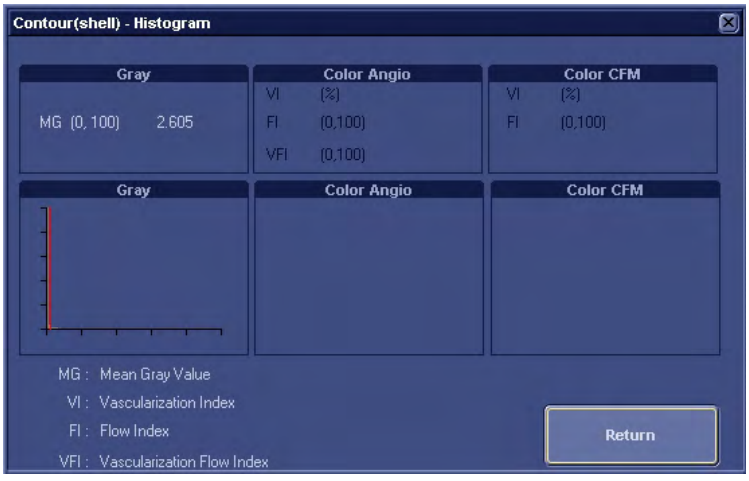
10.3.4.16 Volume Histogram

After volume calculation via the VOCAL II - Imaging program, it is possible to display an automatically calculated (Color Angio) Histogram of the volume.



Select the [Histogram] item in the Vocal menu.

Following window with the calculated histogram appears on the screen.



If a *shell* is defined, the histogram is calculated from the content of the shell. If a *contour* without a shell is defined, the histogram is calculated from the content of the contour.



Select the [Return] button on the screen to exit the Volume Histogram function.

Note *The Volume Histogram is not possible after 3D+CFM Acquisition.*

10.3.5 Tomographic Ultrasound Imaging (TUI)



Select this item from the visualization modes menu or press 5 key to define TUI as active visualization mode.

10.3.5.1 Introduction

The data is presented as slices through the data set, which are parallel to each other. An overview image, which is orthogonal to the parallel slices, shows the parts of the volume, which are displayed, in the parallel planes. This method of visualization is consistent with the way other medical systems such as CT or MRI, present the data to the user. The distance between the different planes can be adjusted to fit the requirements of the given data set. In addition it is possible to set the number of planes.

The planes and the overview image can also be printed to a DICOM printer, for easier comparison of ultrasound data with CT and/or MRI data.



10.3.5.2 Operation

The TUI main menu:





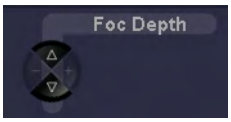
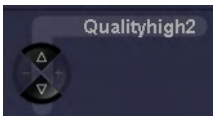
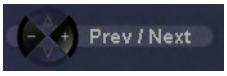
Use the trackball to define the position or the size of volume-renderbox.

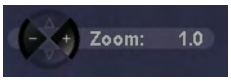


Use the upper- trackballkey to change between the position an the size of volume rendering.



Use the right-trackballkey to start the volume rendering.

Menu item	Description
	Use the [Foc Depth] Menu button to select the depth position of the actual focus zone(s). Use the [up] and the[down] buttons to change the Foc Depth. The marker arrows mark the depth position of the focal zone(s).
	Select the Quality. This function changes the line density against acquisition speed.
	Changes the angle of the volume renderbox. Choose from 5˚ to 85˚.
	Slices: Can be adjusted from 3 to 19 slices Dist.: Distance of slices can selected from 0.5mm to 10mm
	Use the [Prev/Next] buttons to select the previous or the next slice.

Menu item	Description
	Zoomkey: Zoom to the slices.
	Changes the number of slices on the screen. Choose between [2x2]and[3x3] slices.

10.3.6 SonoVCAD Heart - Volume Computer Aided Display

Note *SonoVCAD Heart is optional. Please contact your local sales representative for further information.*



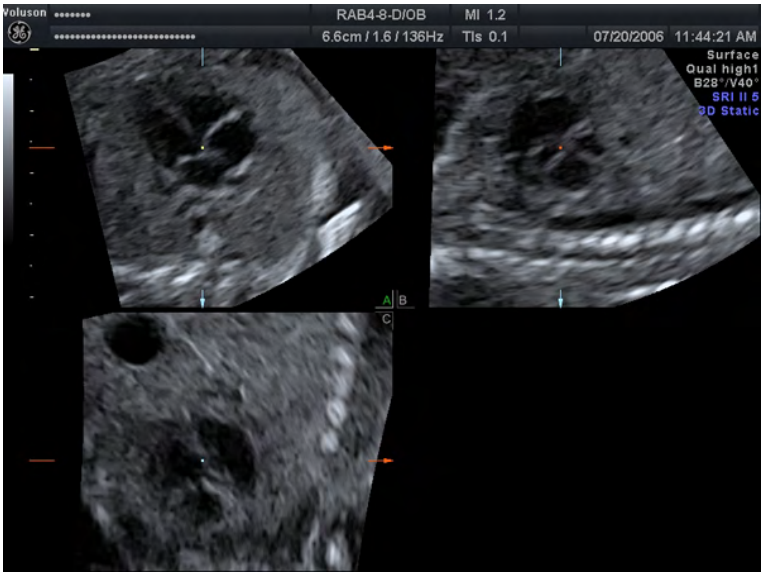
Select this item from the visualization modes menu or press 6 key to define VCAD as active visualization mode.

10.3.6.1 General Description

VCAD is a technology that automatically generates a number of views of the fetal heart to make diagnosis easier.

10.3.6.2 Before VCAD Operation

Acquire a 3D/4D view of the fetal heart. Ideally, the acquisition should start with a four-chamber-view.

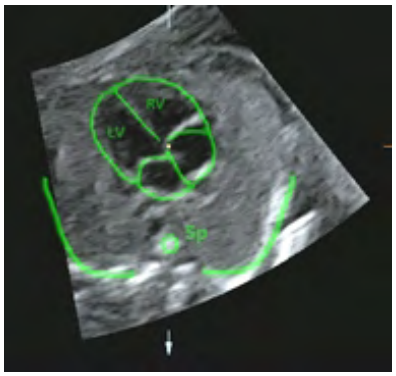


Menu item	Description
	Press this key to switch on and off the heart template
	If the fetus is in breech position, press this key to turn the image 180º around the y-axis.

Menu item	Description
I Init	Touch this key to reset the rotations and translations of a volume section to the initial (start) position, see'Principle of Sectional Image Analysis' *on page 10-84*.
P Set Starting Plane	Press this key to display the VCAD application menu.
R SRI II	Press this key to switch on and off SRI ('Speckle Reduction Imaging (SRI II)' *on page 10-76*
S Sub Menu	Open the 3D/4D Sub menu.

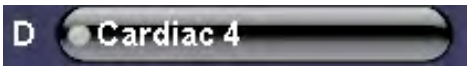
10.3.6.3 Operation

1. If you can already see the heart template on the monitor you can start adjusting. If you cannot see the heart template on the monitor, press the [Plane Graphic] button. The heart template appears.



2. Adjust the US image, using the active mode-rotary control and the zoom button so that it fits the template. To adjust the center of rotation, see '3D Screen control' *on page 10-3*
3. Press the [Set Starting Plane] button. If you have not been in TUI mode the monitor will switch to TUI mode now. The following menu items will appear in the left menu bar

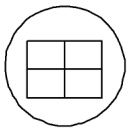
Menu item	Description
F Format 3x3	Select between display of 9 (3x3) TUI slices or 4 (2x2) TUI slices.
N Set New Plane	Press the [Set New Plane] button to get back to the SonoVCAD Heart Main menu.
P Start Plane	or press [Start Plane] to view the Start Plane again.
A Cardiac 1	Press [Cardiac 1] to view the left outflow tract.
B Cardiac 2	Or press [Cardiac 2] to view the right outflow tract,
C Cardiac 3	or press [Cardiac 3] to view the fetal stomach.

Menu item	Description
	Press the [Cardiac 4] button to view Venous.
	Press the [Cardiac 5] button to view DA.

10.4 Display modes and special visualisation modes

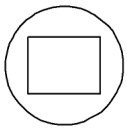
10.4.1 Screen layouts

10.4.1.1 A,B,C - Sectional Plane Mode



This display mode is active if you press the **[Quad]** screen format key. The 3 sectional planes A, B and C are standing normal to each other. The intersecting lines of the planes are the axes of the relative coordinate system and they are displayed in colors in the different images planes. This display mode is basic for the other display modes.

10.4.1.2 Reference Image Mode

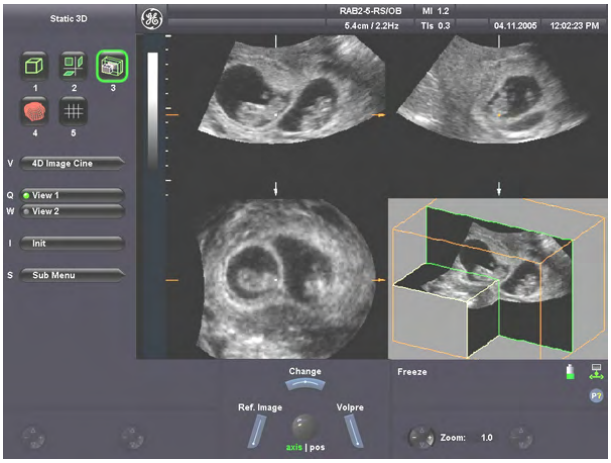


Pressing the **[Single]** screen format key will magnify x2 and display the reference image A, B or C. For the REF image plane selection the same rules as for sectional planes mode apply. The graphic display of the orientation help is not possible.

10.4.2 Niche Display Mode

Parts of the orthogonal sections A, B and C are compiled to a 3D section aspect. The name “Niche” has been chosen because the aspect shows a quasi spatial cut into the reference image.

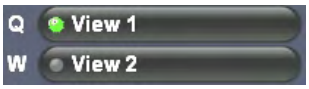
1. Select the [Niche] display format item. The Niche display mode appears on the monitor.





2. Select the reference image A, B or C by pressing the left trackball key repeatedly. (e.g. **A**)
The selected reference image is surrounded with a green line.

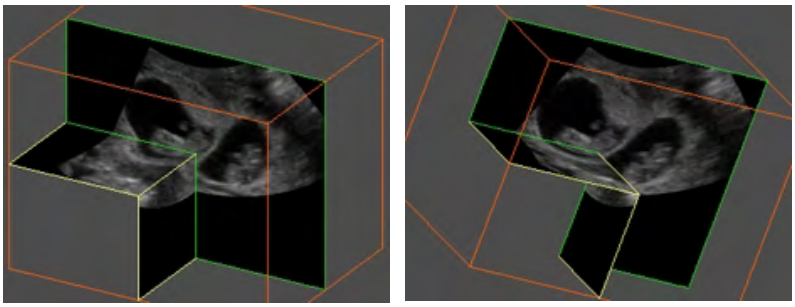
Note *This key may have to be reselected depending on the function of the trackball.*



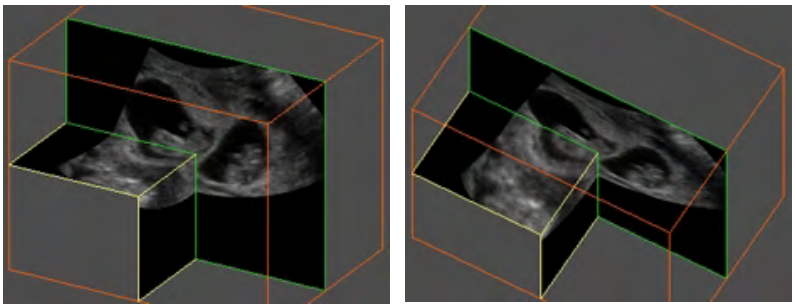
4. Move the trackball to the desired view direction for the niche mode and press the right or left trackball key [Set].

1. Move the trackball to rotate the niche mode image about the selected axis.

- Y-axis [horizontal]



- X-axis [vertical]





Position the images in the niche mode display with the trackball.



Use the upper trackball key to change the function of the trackball from image position to axis position.

Remarks:

- Selection and Rotation of the Niche mode image may also be performed with the navigation wheel.
- Use the **[Single]** screen format key and the **[Quad]** screen format key to change from full to quad Niche display and vice versa.
- Use the rotary controls **[X-axis]** , **[Y-axis]** , **[Z-axis]** to rotate the volume about any one of the axes. Rotation about X-, Y- and Z-axis can be performed liberally.
- Perform the parallel slicing of the image axis by rotating the **[Par. shift]** rotary control for the selected reference image.

10.4.3 VCI Static

Note *Volume Contrast Imaging is an option. If this option is not installed, the [VCI Static] key is hidden.*

[VCI Static] is a separate “Visualization” mode (compared to VCI A-Plane ('Volume Contrast Imaging (VCI A-Plane)' *on page 10-18*) and VCI C-Plane ('Volume Contrast Imaging (VCI C-Plane)' *on page 10-19*), which are “Acquisition” modes). The data is represented as in Static 3D - Sectional Planes. However, the three planes are VCI renderings (tissue information of a thick slice), computed from the 3D dataset.



1. Select [Sectional Planes] to evoke the sectional planes menu.



2. Select [VCI Static] to evoke the VCI Static menu

10.4.4 SonoVCAD labor

Note *SonoVCAD labor is optional. Please contact your local sales representative for further information.*

This feature allows for supervision of labor using specific measurements aided by on-screen orientation marks.

10.4.4.1 Operation

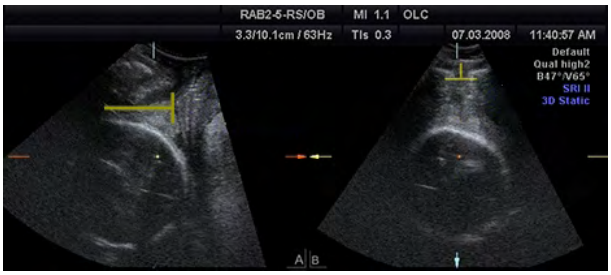
Menu item	Description
	Click this menu item or press A to align the volume automatically.
	Click this menu item or press P after you have finished aligning the volume.
	Click this menu item or press B to realign the volume as described in 'Mark pubis position - manual' *on page 10-69*.
	Click this menu item or press G to toggle display of past measurements on screen.
	Click this menu item or press K to set the skull contour as described in 'Set fetal contour' *on page 10-70*. The checkbox controls whether or not the contour line is displayed in the ultrasound image.
	Click this menu item or press H to set the head direction as described in 'Set head direction' *on page 10-70*. The checkbox controls whether or not the line is displayed in the ultrasound image.
	Click this menu item or press M to set the mid line as described in 'Set midline' *on page 10-70*. The checkbox controls whether or not the line is displayed in the ultrasound image.
	Click this menu item or press D to measure the progression of the fetal head as described in 'Head progression distance' *on page 10-71*. The checkbox controls whether or not the line is displayed in the ultrasound image.
	Click this menu item or press A to measure the progression of the fetal head as described in 'Head progression angle' *on page 10-71*. The checkbox controls whether or not the line is displayed in the ultrasound image.
	Click this menu item or press V to delete all measurements for the current volume.

Trackball function	What it does
	• Skull Contour: Set a new anchor point. • Head Direction: Set start / end point. • Mid Line: Set start / end point. • Progression distance: Set end point. • Progression angle: Set end point. • SonoVCAD labor main: Set reference image.
	• Skull Contour: Finish drawing. • Head Direction: No function assigned. • Mid Line: No function assigned. • Progression distance: No function assigned. • Progression angle: No function assigned. • SonoVCAD labor main: No function assigned.
	• Skull Contour: Undo last anchor point setting. • Head Direction: Undo last start / end point setting. • Mid Line: Undo last start / end point setting. • Progression distance: Undo end point setting. • Progression angle: Undo end point setting. • SonoVCAD labor main: Exit to Volpre.

10.4.4.2 Mark pubis position - manual

Bring the volume in the correct position using rotation, translation and zoom.

Align image plane A to the Pubis Longitude mark and image plane B to the Pubis Transverse mark. Confirm the correct alignment by clicking the ***Set Position*** menu item.



10.4.4.3 Mark pubis position - Auto Adjust

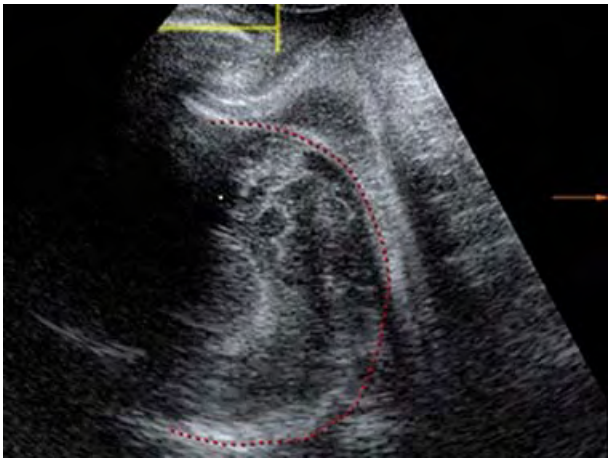
Auto Adjust is a convenient feature to help align the ultrasound image.

Draw a line along the pubic bone in either image plane A, B or both. The other image planes will be aligned accordingly. You can tweak the result using rotation, translation and zoom. Confirm the correct alignment by clicking the ***Set Position*** menu item.



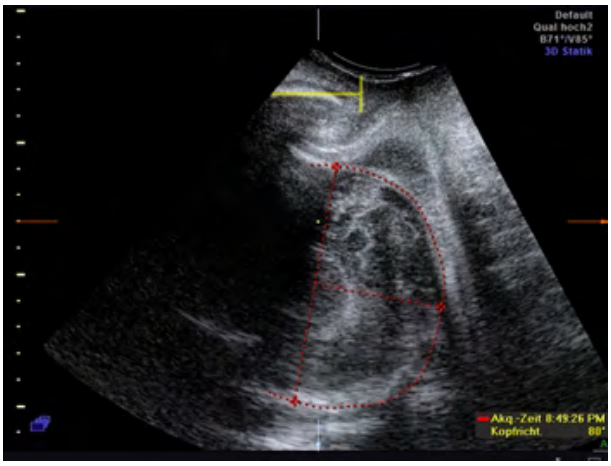
10.4.4.4 Set fetal contour

Trace the position of the fetal head point by point.



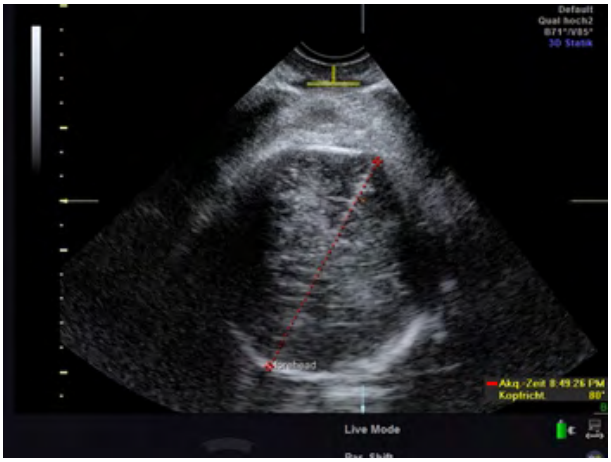
10.4.4.5 Set head direction

Draw a line of two points along the maximum head diameter. Then mark the most distant point of the head contour. The head direction is calculated as a line orthogonal to the max diameter passing through the distal point



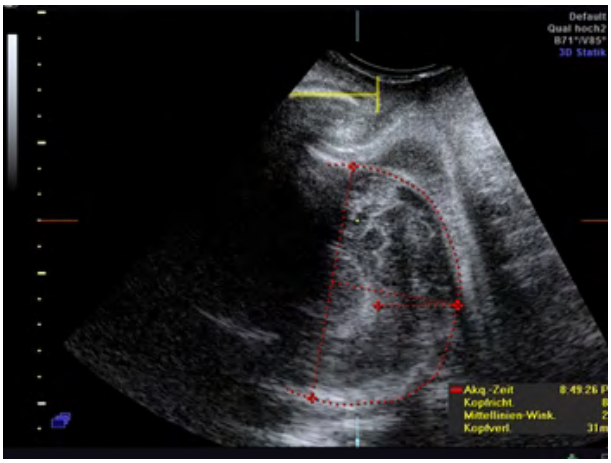
10.4.4.6 Set midline

Mark the position of the midline with a line of two points. The measurement result is the calculated angle between the vertical axis and the midline. As the rotation can be to the left or to the right it is necessary to start measuring at the occiput to get acurate results.



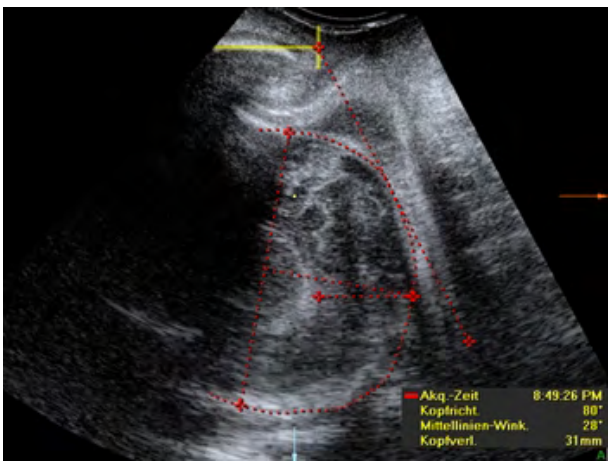
10.4.4.7 Head progression distance

Perform this measurement in image plane A. The measurement's point of origin is vertically locked to the pubis. Mark the distal point of the fetal head to measure the distance between the pubis and the head in millimeters.



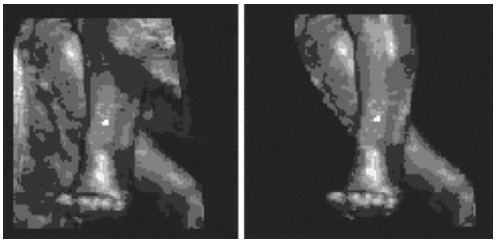
10.4.4.8 Head progression angle

Perform this measurement in image plane A. Starting from the center of the pubis, set the end point that the dashed line is tangent to the fetal head. The resulting measurement is the dihedral angle between the pubis and the defined line.



10.4.5 MagiCut

This software has the ability to electronically edit the images, and makes it possible to cut away "3D artifacts".



The left image displayed above is rendered without cutting, whereas the right image has had cutting techniques applied to give a clearer view of the object of interest.

The cutting function makes six methods available for cutting. These different methods can be used in different cases so that there is an unobstructed view to the object of interest.

The following image shows a 3D rendered image before 3D cutting, and after. The cutting was performed by rotating the image to give the best view and utilizing the ’contour inside’ method.



For operation review: MagiCut Operation 'MagiCut Operation' *on page 10-72*

Note *The cutting function is only available on a 3D rendered image.*

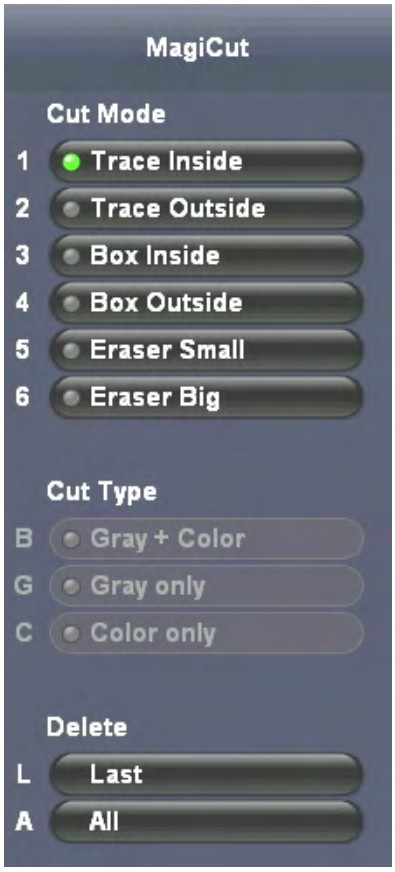
Note *In a combined display mode (Pictogram mode: 3D image + 2D sectional planes) the cut information still remains in the 2D planes.*

10.4.5.1 MagiCut Operation



1. Select the [MagiCut] item.

Following menu appears in the menu area.



Remark:

- The system switches to “ROI 3D Quad mode” (if not active) for editing the render box.
- 3D image display is activated if not active.

2. Use the screen control to rotate the rendered 3D image to a position where the 3D artifacts or undesired information can be cut. '3D Screen control' *on page 10-3*

3. Select the “Cut Mode” and set the region of interest to be cut

Trace Mode inside, outside



Trace Inside: The image within the contour will be discarded. Trace Outside: The image outside of the contour will be discarded.

Position the first point, enter it with right or left trackball key [Set] and move the cross along the desired trace. The red lines marking the trace set automatically. Press the right or left trackball key [Set] again. The region inside/outside the trace will be cut from the 3D rendered image.

If a contour is left open, the program will automatically close the contour with a line directly from the end point to the start point.

- **Box inside, Box outside**



Box Inside: All information inside the box will be cut. Box Outside: All information outside of the box will be cut.

Position the left upper point with the trackball and enter it with the right or left trackball key [Set]. Position the right lower point with the trackball in a diagonal fashion to create a box. The red trace of the box is displayed immediately. Press the right or left trackball key [Set] again. The region inside/outside the box will be cut from the 3D rendered image.

Eraser



Eraser Small/Big: All information underneath the eraser will be cut.

Position the first point, enter it with the right or left trackball key [Set] and move the eraser over the part of the image to be erased. Press the right or left trackball key [Set] again. The region underneath the eraser will be cut from the 3D rendered image.

4. Cut Type



This selection is only possible in render mode Glassbody.

Position the first point, enter it with the right or left trackball key [Set] and move the cross along the desired trace. Press the right or left trackball key [Set] again Use the [Depth] key to define the cut.

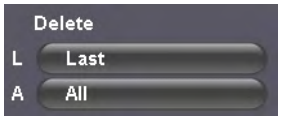
To finish:

Press the right or left trackball key [Done]. The region underneath the trace will be cut from the 3D rendered image.

5 Perform the next cut

Rotate rendered image to another position and continue with points 2. to 4. again.

6 Cut Undo



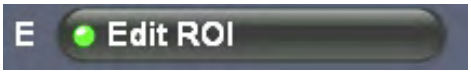
last: Erases the last cut done (one after the other).

All: Erases all cuts performed.

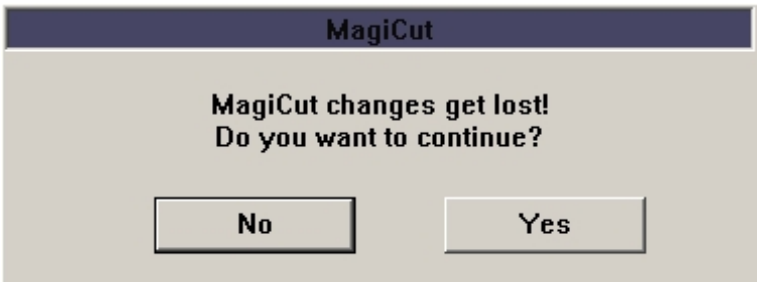
7 Switch off MagiCut mode



Press this key on the control panel. The “Static 3D” menu appears again.



Note *If a cut 3D image is displayed and one switches to 3D ROI mode,a warning is displayed on the monitor.*



10.4.6 Orientation Help Graphic

The orientation help image shows only the position of the actual reference image plane within the volume body without direct relation to the patient.

The orientation help image is only displayed in the lower right quadrant in Sectional Planes Mode.



To activate or deactivate the Orientation Help Graphic select the [O.H. Graphic] item in the “3D/4D Main” menu.



e.g.: O.H Graphic of an Abdominal Transducer.

Please note: The O.H. Graphic of the transvaginal 3D volume transducer is inverted.

Note *The alignment of the volumebody is NOT the alignment of the patient’s body.*

10.4.7 Speckle Reduction Imaging (SRI II)

Speckle Reduction Imaging (SRI) is a smoothing type filter to reduce speckles in the ultrasound image. It may be used with any probe or clinical application when image speckles interfere with the desired image detail.

This filter smoothes the final image (structures can be smeared out).

For a diagnosis, the Region of Interest must be checked without SRI filter.



Activate the [SRI] function in 2D mode and change the level of smoothing by pressing between [SRI II Low] and [SRI II High].

SRI-supporting visualization modes:

- 2D mode, Power Doppler mode, Color flow mode, HD-Flow mode.

  In 2D mode, SRI and CRI (see 'Compound Resolution Imaging (XBeam CRI)' *on page 5-5*) can be combined.

10.5 Cines

10.5.1 Auto Cine



1. Press the upper trackball key **[Auto Cine]** to display the “4D Volume Cine” menu.

Following menu appears:





2. To start the sequence press left or right trackball key. The selected volume is simultaneously displayed on the screen.



3. Select the review speed



Scan in both directions through the image block: First image...last image, last image...first image, etc. Scan in one direction through the image block: First image...last image, first image...last image, etc.



Press the right trackball key **[Start],** the Cine is active. The key changes to **[Stop]** key.

By touching this key again the selected volumes of a Real Time 4D sequence will be displayed volume by volume with the trackball.

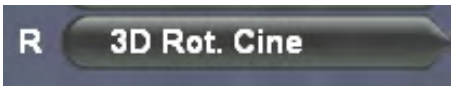
10.5.2 3D Rotation Cine

To get an overall 3D impression of the rendered object a certain number of calculated views are displayed image by image in a fast sequence. The rendered object, so to speak, is rotating for the observer.

Transparent mode:

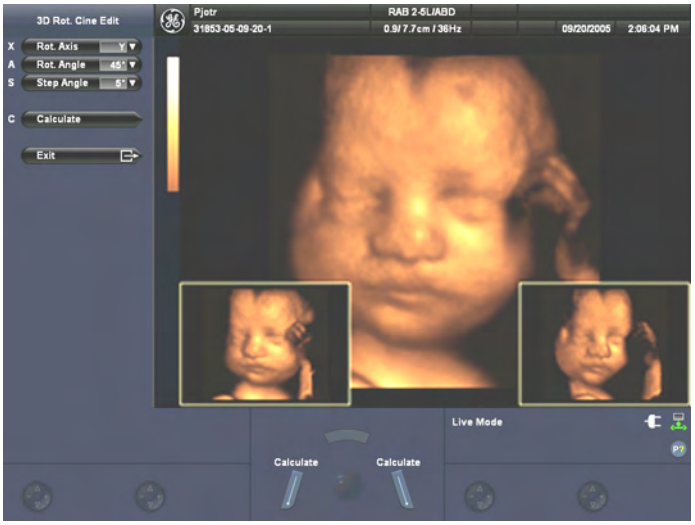
Only rotation of the object enables a 3D impression due to the movement of the structure.

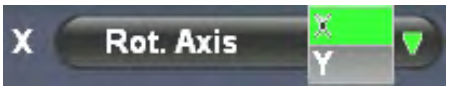
10.5.2.1 To calculate a 3D Rotation Cine Sequence



1. Activate the “3D Rot. Cine” display mode.

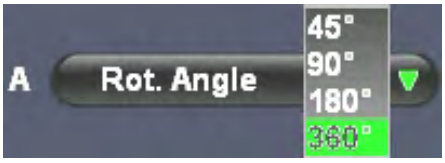
The “3D Rot. Cine Edit” menu is displayed on the monitor.





2. Select the Rotation Axis

Select between X and Y rotation of the 3D cine sequence.



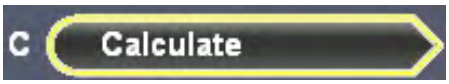
3. Select the Rotation Angle

Select the rotation angle desired.



4. Select the Step Angle

The step raster defines the amount of rotation between adjoining 3D images.



5. Select Calculate



Alternative press either the right or left trackball key [Calculate]. Image after image of the sequence is calculated and stored in the cine memory. After the calculating is done the rotating cine sequence is displayed on the screen.

To break the Cine calculation:



Activation of the right or left trackball key [Stop] stops the actual calculation. If at this moment no image calculation has been performed, an automatic return to the 3D ROI menu will happen.

If, however, at least 1 image calculation is finished (status line “Calculating image” shows a number > 1), the calculation quit, the calculated cine sequence (until to the interruption) is displayed and the cine menu appears.

Possible operation of a displayed cine sequence review: Start/Stop the calculated Sequence 'Start/Stop the Calculated Sequence' *on page 10-79*

10.5.2.2 Start/Stop the Calculated Sequence



Toggle function: [Start / Stop] Press the right or left trackball key to start the 3D cine sequence. On screen the cine sequence begins rotating (if not rotating already).

Loop Mode Direction

If several 3D images have been calculated, they can automatically be displayed in a sequence.

Images in Transparent mode will only render the 3D effect in this manner.



Scan in both directions through the image block: First image...last image, last image...first image, etc. Scan in one direction through the image block: First image...last image, first image...last image, etc.

Select the speed of rotation



The speed of sequencing through the number of images can be varied between: 6%, 12%, 25%, 50%, 100%, 200%, and 400%.

Select the zoom level



The 3D image magnification can be varied by using the menu soft buttons.

Selection of single images



After pressing the right or left trackball key [Stop] move the trackball horizontally and you can select each single image step by step. Press [Start], right or left trackball key to resume automatic rotation. The displayed number indicates: (2 / 10): image number of the sequence.

Mix the calculate modes



Press this Menu control adjusts the mix ratio between the two calculated modes.

Edit calculated Cine sequence



By selecting this item the “3D CinePre” menu appears again.

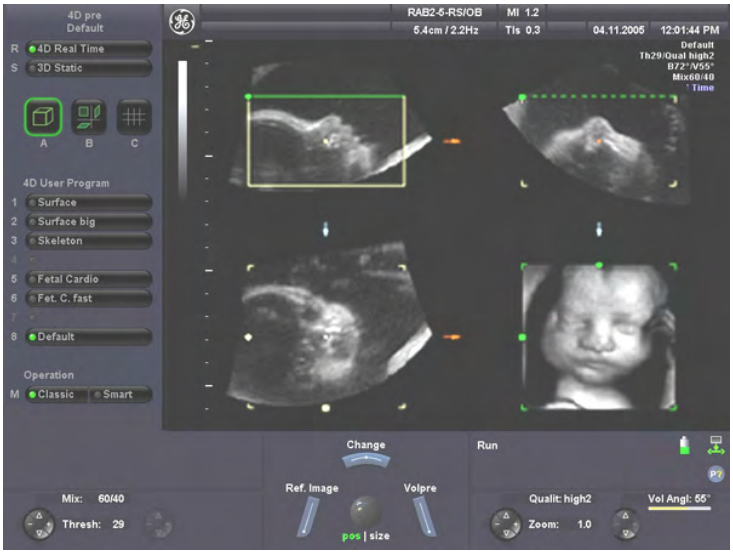
10.6 Volume ultrasound - Theory

10.6.1 General Description

The Volume Mode allows for scanning a tissue volume and subsequent analysis of sections of the volume in 3 dimensions. The liberal selection of sections within the volume and the simultaneous real-time 4D display of three orthogonal planes and a rendered three dimensional Image represents a new dimension for e.g., the diagnosis of fetal abnormalities.The Volume Mode provides access to sections unachievable by the 2D scan technique.

A parallel interface provides the possibility to memorize volume data on a hard disk drive for repeated analysis anytime.

Example of fetal "facing" by liberal selections of sections:

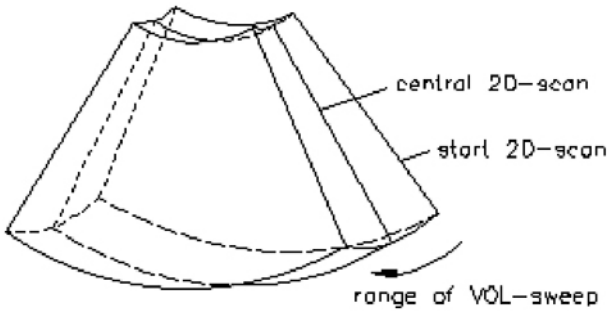


The volume data sets may be processed by means of the visualisation mode “Rendering” for surface or transparent mode images.



10.6.2 Principle of Volume Acquisition

The acquisition of volume data sets is performed by 2D scans with special transducers designed for the 2D scans, the 3D sweep, and the real time 4D scans. The Volume acquisition is started using a 2D-image with superimposed VOL-Box or using a 2D+Color image. In case of a 2D+Color image the Color-Box is at the same time the VOL-Box. The 2D start image represents the central 2D scan of the volume. The volume scan itself sweeps from one margin to the other margin of the volume to be acquired.



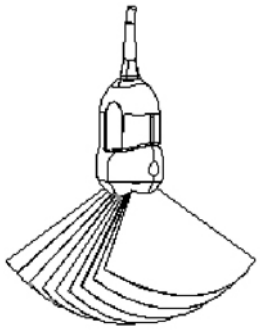
The VOL BOX frames the Region of Interest (ROI) which will be stored during the volume sweep. The display shows the actual 2D scan.

The sweep time varies and depends on the VOL-BOX size (depth range, angle) and the quality (6 positions). The probe must be held steady and in place during the 3D volume scan. The real time display of the swept B frames allows continual observation of the scan quality. During the real time 4D scan it is not necessary to hold the probe steady because of the continuous volume acquisition.

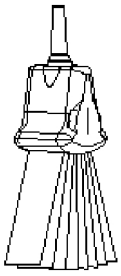
10.6.3 Principal Scanning Modes

The volume scan is automatically performed by a tilt movement of the 2D scan head.The scanned volume is similar to a section of a torus.

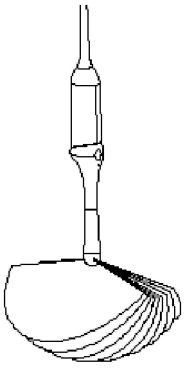
Transducer type:



Abdominal



Small parts

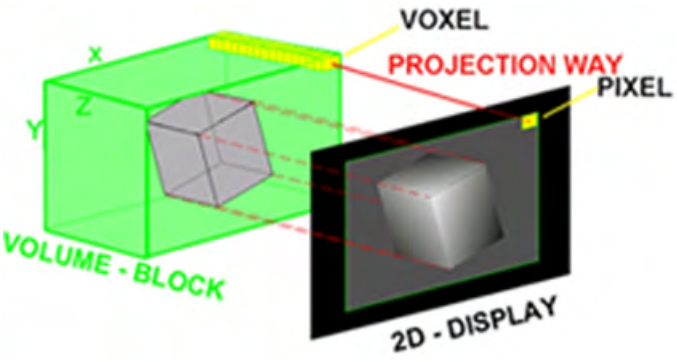


Transvaginal

10.6.4 What is Interactive 3D Image Rendering?

The 3D Image Rendering is a calculation process to visualize certain 3D structures of a scanned volume by means of a 2D image. The gray value for each pixel of the 2D image is calculated from the voxels along the corresponding projection path (analyzing beam) through the volume.The render (calculation) algorithm surface or transparent mode decides which 3D structures are visualized.

Please review also: Volume Acquisition: 3D Rendering 'Volume Acquisition: Static 3D' *on page 10-21*



10.6.4.1 What is Interactive?

Interactive means that every operation/adjustment concerning the result of the rendering process can be followed in real time. The fast hardware and intelligent software enables calculation in real time rendered pictures. After an operation step the result is rendered with a lower resolution in order to speed up the interactive feedback, and when no operation takes place the result is rendered in high resolution.

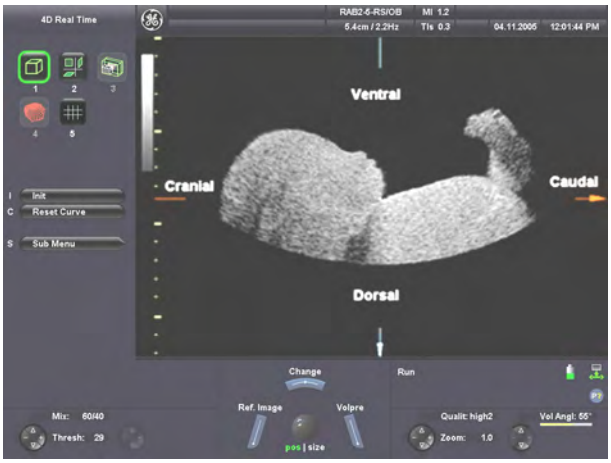
10.6.5 Image Orientation (All Acquisition Modes)

Start condition:

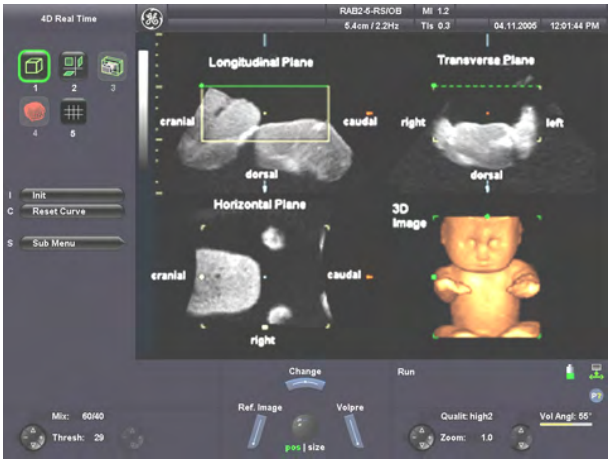
B image:

Adjust a longitudinal scan of the object desired. Switch on 3D mode and start the volume acquisition.

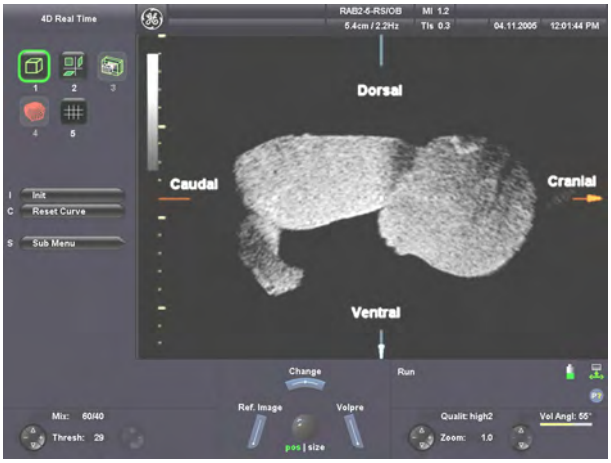
B image orientation: **up -> down**



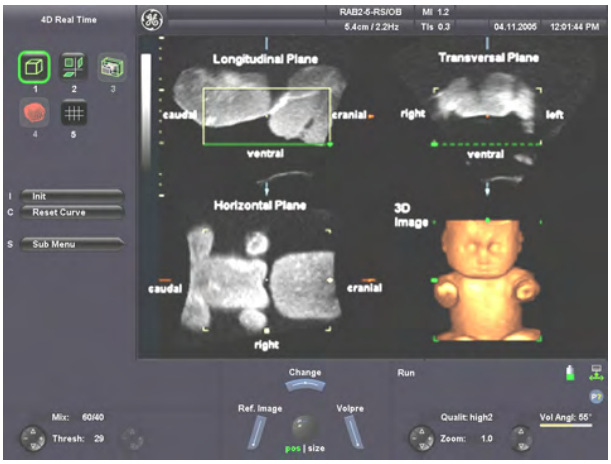
Resulting orientation of sectional planes (read mode).



B image orientation: **up -> down**



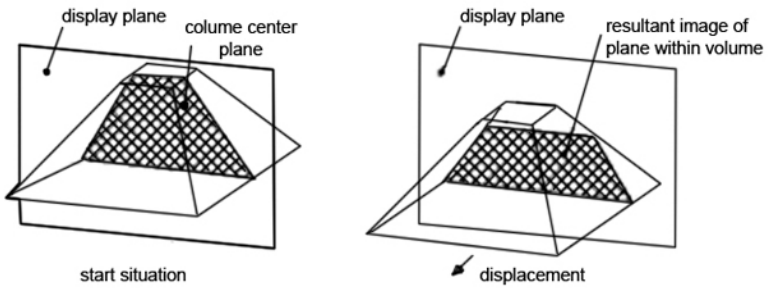
Resulting orientation of sectional planes (read mode).



10.6.6 Principle of Sectional Image Analysis

The display screen shows that sectional plane located within the volume, which has been selected by rotating and shifting of the volume body in relation to the display plane.

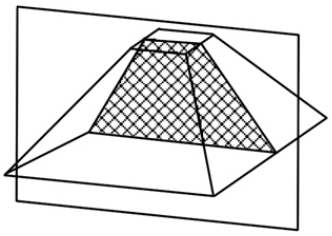
Displacement of the volume body relative to the display plane:



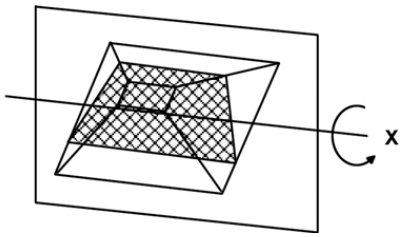
Rotation of the volume body in relation to the display plane:

The rotation can be about the X-axis or the Y-axis of the display plane, or the Z-axis which is normal to the display plane.

Start situation



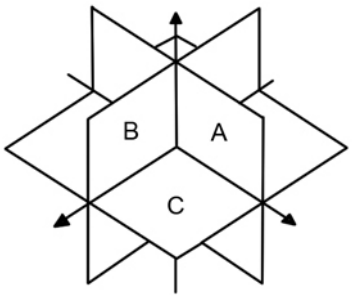
Rotation (about X-axis)



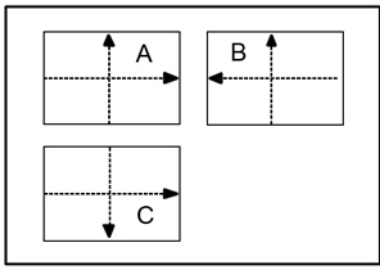
The position of the volume body in relation to the display plane is determined by a relative coordinate system. This is made up of three orthogonal axes, the common intersection of which is the 3-axial center of rotation. These axes are displayed within the display plane - exactly in the X-, Y- and Z-directions and colored. Rotation about any of these axes and displacement of the center of rotation make any imaginable plane within the volume body displayable. The INIT position of the volume body in relation to the display plane is resetable; it is the start situation after completion of a volume scan.

The standard representation: 3 sections mode. The 3 orthogonal sectional planes are simultaneously displayed on the quartered screen field of the monitor. Each quarter field displays a sectional view through the volume body as shown below.

Sectional planes A, B, C



Display of A, B, C



The intersection lines of the planes are displayed in colors:

AB = blue

AC = red

BC = yellow

Orientation of intersection lines on the screen:

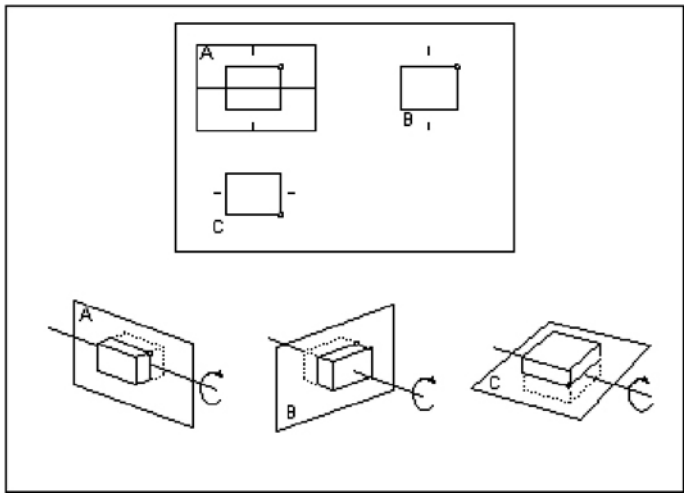
Section/field	A	B	C	
Intersection line AB	V	V	N	V = Vertica H = Horizontal N = Normal
Intersection line AC	H	N	H	
Intersection line BC	N	V	V	

By this definition the relation of the position of the 3 images A, B, C is also defined (as made clear by the direction of arrows). The presentation of 3 orthogonal sectional planes may lead to non-conformance with the conventional customized orientation to the patient in 2D sonography. An identification system - the automatic display of the direction of section - will clarify.

Please note: Whenever a usual longitudinal section (of the patient) is selected for display field A, the usual orientation for longitudinal and transverse sections is valid.

Note *To activate the screen control:* '3D Screen control' *on page 10-3*

10.6.6.1 Rotation and Reference images

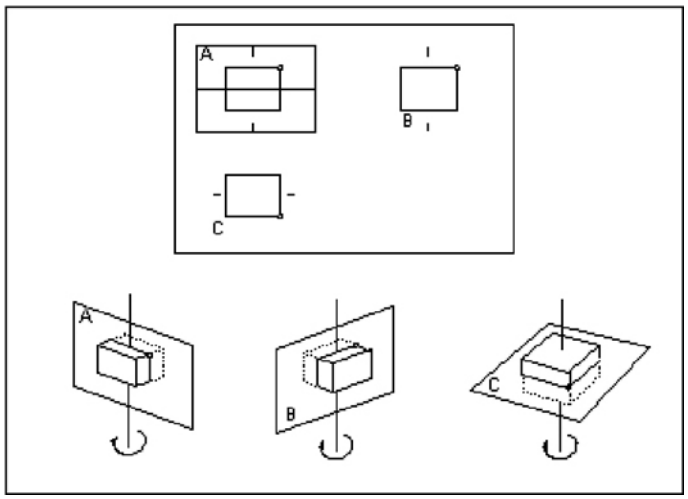


By the clockwise rotation of the volume body relative to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.



Rotation about the Y-axis of a reference image (e.g., **A**).

Clockwise turn of the [Y-axis] rotary control:

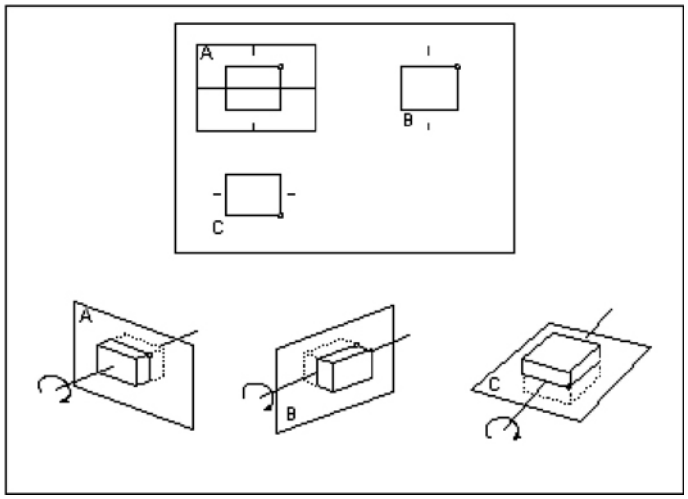


By the clockwise rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.



Rotation about the Z-axis of a reference image (e.g., **A**).

Clockwise turn of the [Z-axis] rotary control:



By the clockwise rotation of the volume body in relation to the screen plane (as shown) the new sectional planes are calculated in real time and displayed on screen.

Important notes for the user:

- Rotation should be performed slowly to understand the orientation



- Do not rotate by large angles except when the orientation left/right or up/down is to be changed. At 90º rotation about an axis, the sections A, B, C will change:
- Reference image e.g., **A**:

X-axis: A ´ C

Y-axis: A ´ B

Z-axis: B ´ C

- Before performing a rotation, position the center of rotation at that part of the image which you don’t want to lose.

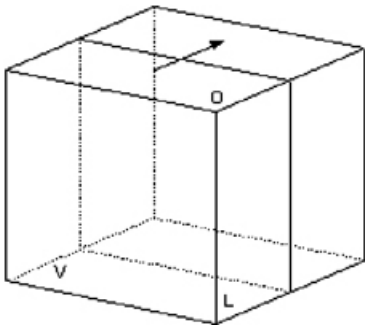
10.6.6.2 Translations

The translation allows displacement of the center of rotation along the intersection lines of the sectional planes A, B and C. The displacement of the center of rotation leads to the display of parallel sectional images.

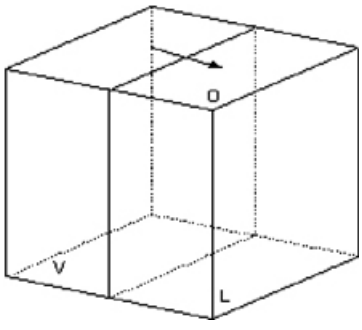
To perform parallel slicing of images rotate the [Parallel shift] rotary control.



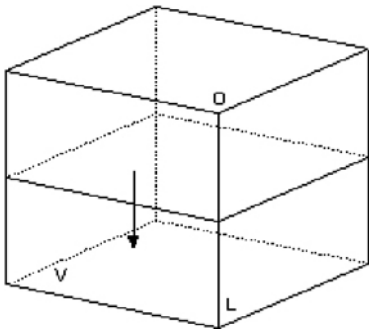
Clockwise turn of the [Parallel shift] rotary control:

Reference image: A	

The sectional plane migrates from the front to the rear through the volume body.

Reference image: B	

The sectional plane migrates from the left to the right through the volume body.

Reference image: C	

The sectional plane migrates from the top to the bottom through the volume body.

Important note:

The terms "front, left, top" etc., are **not** orientated to the patient, but serve for explanation. Of course, the "patient" could possibly be rotated to achieve the position described.

Parallel movement of the reference image will display the new intersection lines with the non-reference images. The sectional planes of the non-reference images are not altered.

Axis positioning of the center of rotation in the reference image:



The center of rotation can be X/Y-positioned by the trackball. This causes also a parallel displacement of those planes presented by the non-reference images. The intersection line of the non-reference images with the reference image will undergo a parallel X or Y shift accordingly.

IMPORTANT:	-	Positioning the center of rotation in the reference image marks that point which will not get lost during the rotation.
	-	It is recommended to use the [Par. shift] rotary control together with the reference selection for the performance of parallel sections. In this mode only one image is concerned by changes, leading to a higher image transfer rate.
	-	Performing parallel sections is simple and easy to understand and therefore should be preferred for a detail exploration of an object.

System feature:

The center of rotation cannot leave the display field A, B or C. In case an intersection line reaches the field border, the line will stay there and the image (with further shift) will continue to move in the shift direction. This is especially helpful when due to magnification the display field is small compared with the area of the plane to be observed.

10.6.6.3 Initial Condition of different Probes

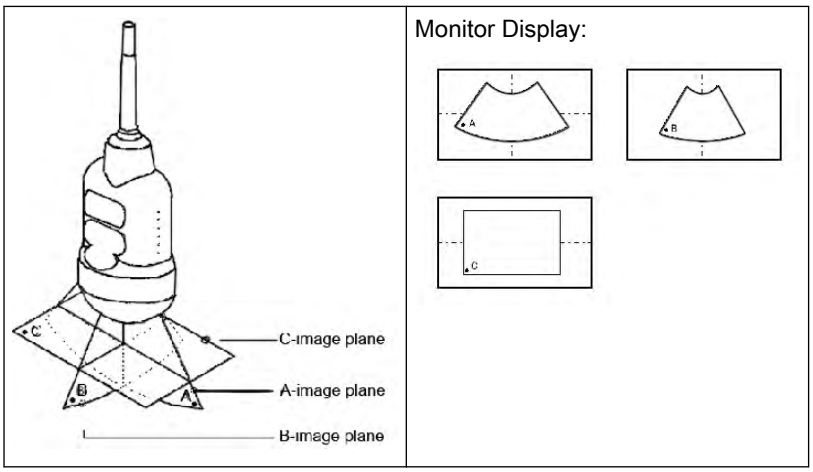


Press the **[Init]** key to reset the rotations and translations of a volume section to the initial (start) position.

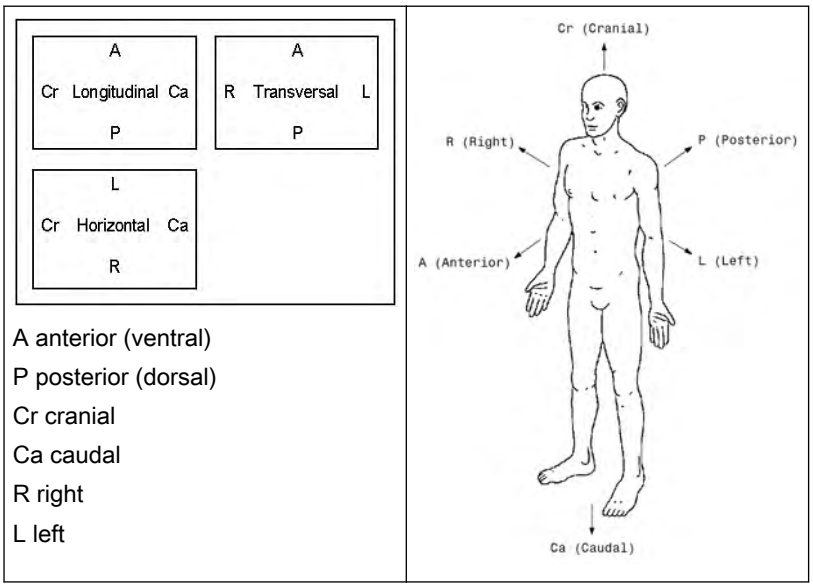
Initial condition of:

- Abdominal probe
- Small parts probe
- Endocavity probe

Init condition of an abdominal probe:

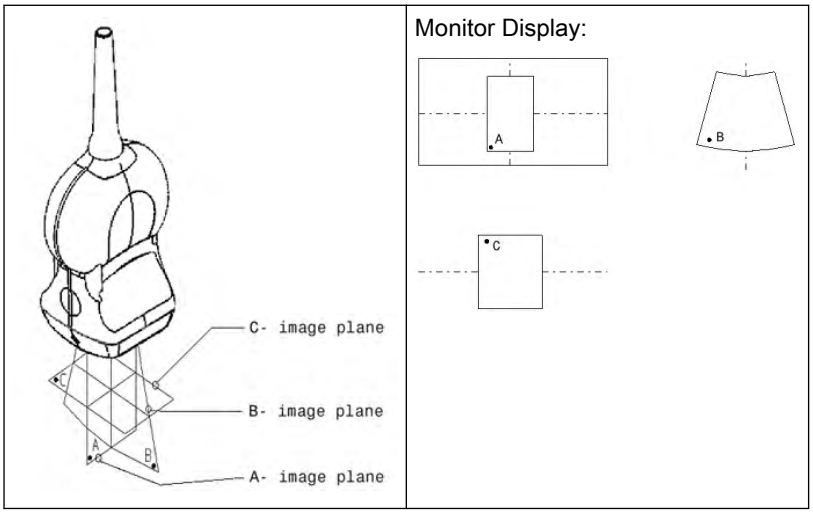


The sectional image A represents that 2D image from which the volume acquisition began. If the VOL-start image is a longitudinal section (Cr on the left of the screen below), the following Init positions are obtained:

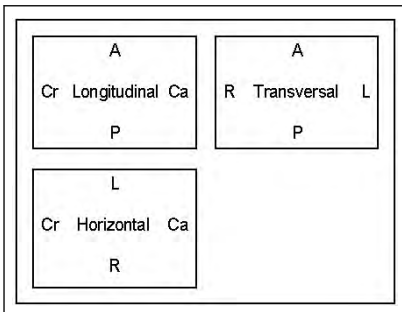


A anterior (ventral)
P posterior (dorsal)
Cr cranial
Ca caudal
R right
L left

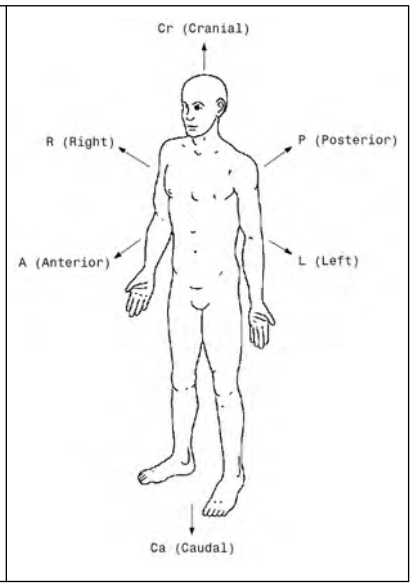
Init condition of a small parts probe:



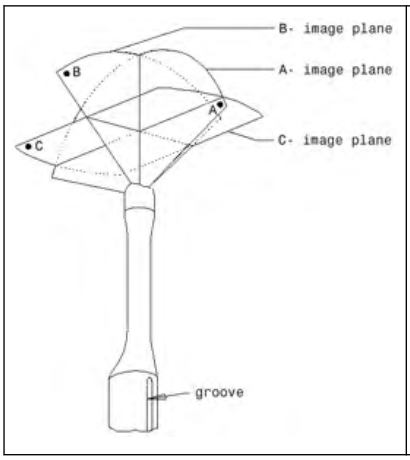
The sectional image A represents that 2D image from which the volume acquisition began. If the VOL-start image is a longitudinal section (Cr on the left of the screen below), the following Init positions are obtained:



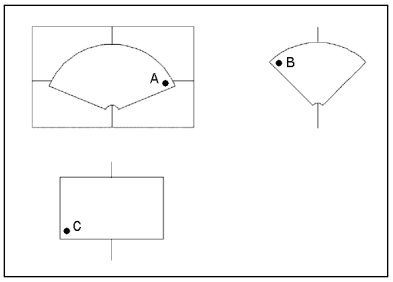
A anterior (ventral)
P posterior (dorsal)
Cr cranial
Ca caudal
R right
L left



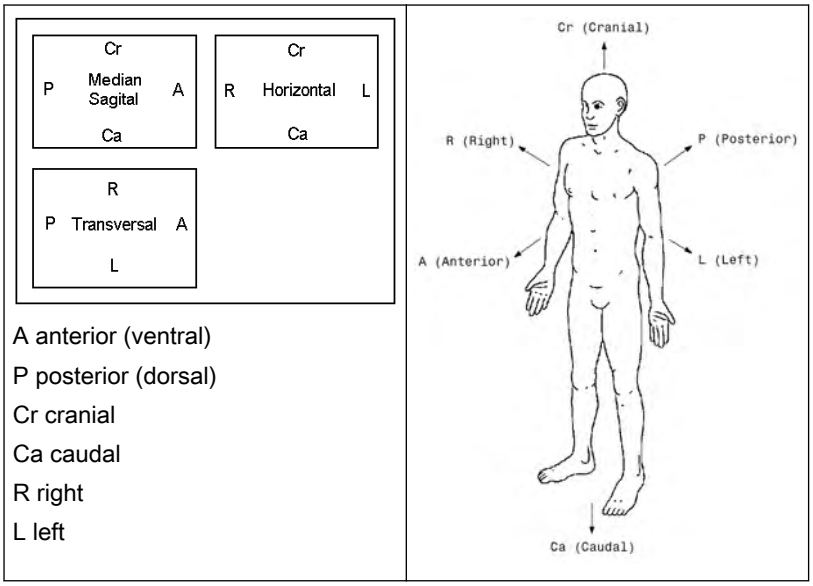
Init condition of an endocavity probe:



Monitor Display:



The sectional image A represents that 2D image from which the volume acquisition began. If the VOL-start image is a median-sagittal section (left side of the screen is posterior), the following Init positions are obtained:


Cr
P Median Sagital A
Ca
Cr
R Horizontal L
Ca
R
P Transversal A
L
A anterior (ventral)
P posterior (dorsal)
Cr cranial
Ca caudal
R right
L left
Cr (Cranial)
R (Right)
P (Posterior)
A (Anterior)
L (Left)
Ca (Caudal)

Chapter 11

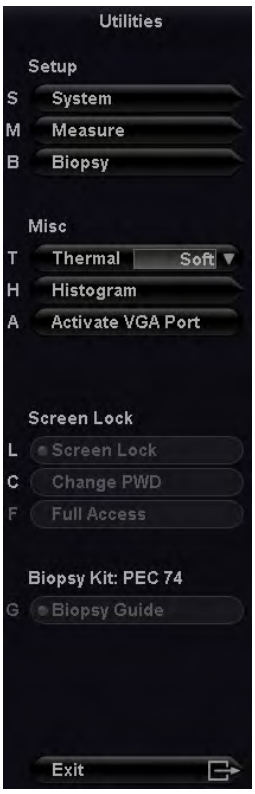
Utilities

Utilities menu allows you to adjust various system settings

Utilities



After pressing the **[Utilities]** key. The menu area changes to the Utilities menu.



In the Utilities menu you find items for programming the System and to switch on diverse functions.

Diverse functions review:

- ' Gray Chroma Map' *on page 11-2*
- 'Histogram' *on page 11-7*
- 'Internet' *on page 11-9*
- 'Display of Biopsy Guideline ' *on page 11-10*
- 'Thermal Indices' *on page 11-11*
- 'VGA Port' *on page 11-11*

For System Setup review:

System Setup *Chapter 16*

Measure Setup 'The Measure Setup Pages' *on page 17-3*

11.1 Gray Chroma Map

A gray map determines the displayed brightness of an echo in relationship to its amplitude. A Chroma Map determines the displayed Color of an echo in relationship to its amplitude. Depending on individual requirements a "harder" or "softer" image can be obtained with this function and can be adjusted in Read- and in Write-Mode (post-processing). The displayed gray scale wedge corresponds to the adjusted gray map curve. Different gray map curves can be associated with different imaging modes.

- To select a 2D Gray map review: 2D Gray Map '2D Gray Map' *on page 11-2*
- To select a 3D Gray map review: 3D Gray Map '3D Gray Map' *on page 11-4*
- To select a Chroma map review: Chroma Map 'Chroma Map' *on page 11-6*

11.1.1 2D Gray Map

This defines the relation between echo amplitude (input) and brightness (output) in a look-up table. In total 9 predefined and 3 user Gray Maps are available. You can select a certain map independently for each one of the 2D-, D-, M- imaging modes (for example: Map 5 for 2D Imaging and Map 2 for M-Imaging etc.).



Press the **[Utilities]** key regardless which mode is active.

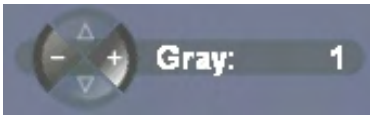
Operation:



1. Select [Gray/Chroma]. The “Gray Chroma” menu will appear.

2. Select the Mode where to change the Gray Map curve. Key bright: the Gray map selection assigned to this mode





3. Select the Gray Predefined or the Gray User curve with the Menu control.



Return to the last active menu.

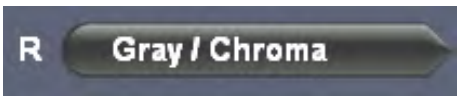


To create your own Gray Map review: Gray Edit Menu 'Gray Edit Menu' *on page 11-5*

11.1.2 3D Gray Map



1. Press the **[Utilities]** key after a volume acquisition.

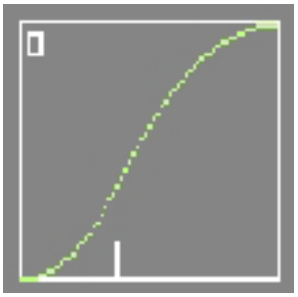


2. Select [Gray/Chroma] to display the “Gray Chroma” menu.



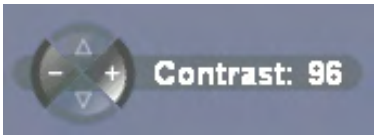
3. Select the [3D] Gray map display mode.

Graphic display on screen:



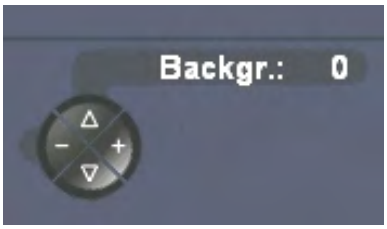
This graphic is provided only for the 3D/4D image.

Horizontal axis: gray values from 0 to 255 Vertical axis: brightness from black to white



5. Set the contrast of the curve.

Note *These settings require an alert observation of the influence on the 3D image!*



Adjust the contrast of the screen background from dark to bright. This function is only of significance in B scanning, when a part of the screen background is visible.



Return to the last active menu.

11.1.3 Gray Edit Menu

With the Edit function it is possible to create a Gray Map Curve.



When switching on the Edit function, the Edit menu appears in the status area and the graphic display of the Gray Map is shown in the status box.

Note *Ensure that the [Trackball Menu Navigation] key is not illuminated!*

Operation:



1. Select the position to modify by switching the corresponding Menu control [Point Sel.] which is shown in the status area.

2. The selected point can now be positioned with the trackball in “X” and “Y” direction.

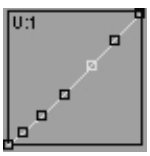
3. To change the position of the other points proceed as in 1. and 2.

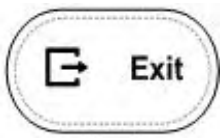
4. Select one of [User 1] to [User 3] items to store the adjusted Gray curve. Use the toggle switch shown in the status area to toggle between gray curves.

Remarks:

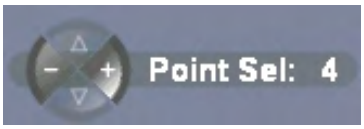
- A spine algorithm generates the curve through all 6 points.

Graphic display on screen:





Return to the previous menu. Note that changes in the Edit Menu will not be stored. The gray map valid before entering a new one in Edit Mode will be valid again.



By switching this Menu control you select a certain position on the Gray Curve.

Note *If you **[Exit]** now, changes in the Edit Menu are stored and the key position remains active in the Gray Menu.*

11.1.4 Chroma Map

This defines the relation between echo amplitude (input) and Chroma value (Color tone and saturation) in a look-up table. The actual Gray Map defines the brightness. You can select from a total of 5, an independent map for each one of the 2D-, D-, M-, or 3D-Imaging modes. (For example: Candle for 2D Imaging and blue for M-Imaging, etc.)



1. Press the **[Utilities]** key regardless which mode is active.



2. Select [Gray/Chroma]. The “Gray Chroma” menu will appear.



3. Select the mode to be colored (2D, M, D, 3D). Key illuminated: Chroma map selection assigned to this mode.



4. Select a Chroma map. The selected Chroma map is switched on and assigned to the selected mode.

Remarks:

The input for the Chroma map is the values given by the actual gray map. Therefore the Chroma map can be modified by altering the gray map.



Return to the last active menu.

11.2 Histogram

With this function the gray scale or color distribution within a marked Region of Interest (ROI) will be graphically displayed. Three histograms may be shown on the screen simultaneously.

There are three possibilities to calculate the gray scale or color distribution:

- 2D Histogram '2D Histogram' *on page 11-8*
- 3D Histogram '3D Histogram' *on page 11-9*

11.2.1 2D Histogram

Operation:

1. Store a 2D mode, CFM mode or a PD mode image.

2. Switch on Histogram by pressing the **[Utilities]** key and selecting [Histogram].

The menu area changes to the Histogram menu.



3. Select the number of histogram: 1, 2 or 3.

4. Use the trackball to place the rectangle over the ROI.

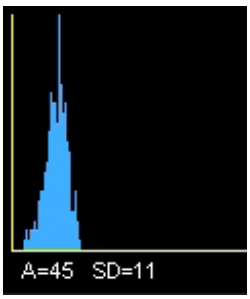
5. The upper trackball key changes from position to size of the ROI and back.

6. Press the right or left trackball key to calculate the histogram. The histogram and corresponding number (left below the box) will be calculated and displayed.

Remarks:

- Measuring, text annotations, bodymarks entering as well as all post-processing settings are not possible in Histogram mode.

Display of gray scale HISTOGRAM



X-axis: grayscale values from 0 to 255

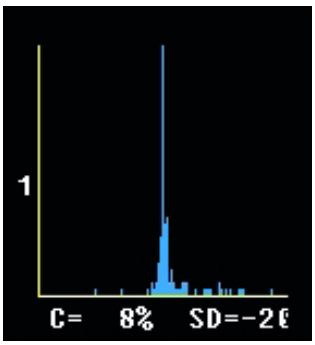
Y-axis: incidence in %, normalized to maximal incidence

A: Average value

A = Sum of [values x presence] Number of values in ROI

SD: Standard deviation

Display of a color HISTOGRAM:



X-axis: color values acc. Color bar

Y-axis: incidence in %, normalized to maximal incidence

C: Color values in %

SD: Standard deviation

11.2.2 3D Histogram

Operation:

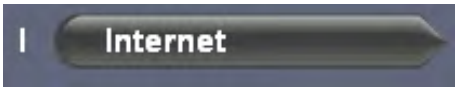
1. Store a 3D, a 3D/PD or a 3D/CFM mode image.
2. After pressing the **[Utilities]** key and selecting the [Histogram] item, the Histogram menu appears on the screen.
3. Select the number of histogram 1, 2 or 3.
4. Use the trackball to place the ROI over one of the sectional planes.
5. The upper trackball key changes from position to size of the ROI and back.
6. Press the right or left trackball key [Calculate]. The histogram with corresponding number will be calculated and displayed.

Note *The display is the same as the display of the 2D Histogram review:* '2D Histogram' *on page 11-8*

11.3 Internet

With this function the user will be automatically connected to the **W**orld **W**ide **W**eb.

Operation:



Call up the Internet browser (Explorer) by selecting the [Internet] item in the “Utilities” menu (full screen).

The mouse cursor is assigned to the trackball.



Click and double click can be performed with the left and the right trackball keys (corresponds with the left “mouse” key). The “Context” menu can be called up with the upper trackball key (corresponds with the right “mouse” key).



Press the **[Exit]** key on the control panel to exit from Internet explorer.

Remark:

- This function is only available if the system is connected to the Internet!

11.4 Display of Biopsy Guideline

WARNING!

- The biopsy lines must be programmed once by the service personnel or by the user. The procedure must be repeated if probes and/or biopsy guides are exchanged!
- Before performing a biopsy make sure that the displayed biopsy line coincides with the needle track (check in a bowl filled with approx. 47ºC warm water). For further instructions review: To program a Single Angle Biopsy Line ' To program a Single Angle Biopsy Line' *on page 17-22 .*

To program a Multi Angle Biopsy Line 'To program a Multi Angle Biopsy Line' *on page 17-23*

- Please read the "Instructions for safe Use" in Probes and Biopsy / Biopsy Special Concerns 'Biopsy Special Concerns' *on page 18-14*.

Operation:



Press the **[Utilities]** key.



Select the [Biopsy] item.

The Biopsy guideline is switched ON if the Biopsy key is highlighted.

To switch OFF the Biopsy guideline, select the [Biopsy] item again. It toggles between ON and OFF.

- To program a Biopsy guideline review:

To program a Single Angle Biopsy Line ' To program a Single Angle Biopsy Line' *on page 17-22 .*

To program a Multi Angle Biopsy Line 'To program a Multi Angle Biopsy Line' *on page 17-23*

Remarks:

- For Handling, Sterilization, Mounting a biopsy guide, etc. review: Biopsy Special Concerns 'Biopsy Special Concerns' *on page 18-14*.
- For each probe one biopsy guideline is programmable.

11.5 Thermal Indices

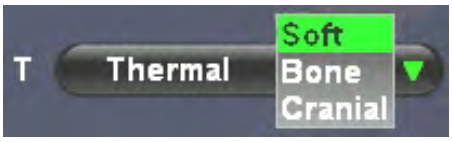
With this function the user can select the required Thermal Index for display:

- **TIS** (Soft Tissue Thermal Index)
- **TIB** (Bone Thermal Index)
- **TIC** (Cranial Bone Thermal Index)

Operation:



1. Press the **[Utilities]** key.



2. Select the [TI sel.] item to open the dropdown menu.

3. Select the required Thermal Index.

Remarks:

- While you are scanning, notice the index numbers you are using and which controls affect the readings.
- Try to keep the index numbers as low as you can, while maintaining diagnostic information within the image. This is particularly important when scanning the fetus.

For details review: Reporting Tables'Reporting Tables' *on page 2-15*.

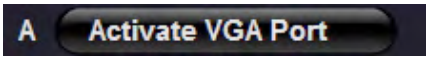
11.6 VGA Port

Activate this feature to enable output to an external monitor.

Note *Connect the external monitor to the VGA Port of your Voluson® i before you activate it.*



1. Press the ***Utilities*** key

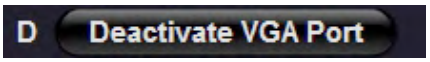


2. Select the Activate VGA Port item to activate the VGA Port.

How to deactivate this feature:



1. Press the ***Utilities*** key



2. Select the Deactivate VGA Port item to deactivate the VGA Port.

11.7 Screenlock

11.7.1 Introduction

Screenlock is a security function. It protects the system by password against unwanted intruders. There are three ways to activate Screenlock:

- by pressing the [Screenlock] softkey
- on boot up
- as soon as the screensaver starts

When screenlock is active, a full-screen dialog with no titlebar or menu appears. To regain full access onto your system enter the password in the text field in the lower left corner. In case you have forgotten your password, you can enter the system in an emergency mode by pressing the emergency button. The emergency mode will not give you full access, but still allow you to scan and save patients.

When the screenlock is activated the system is configured as follows:

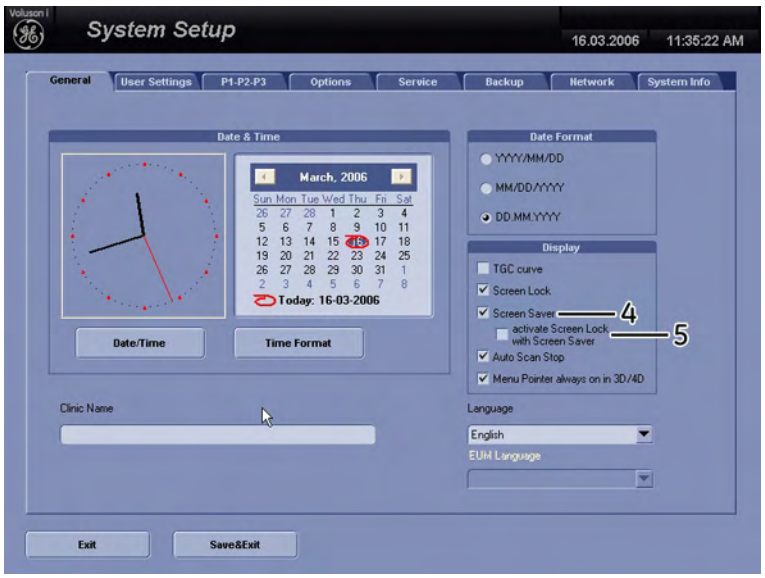
- All scanning activities are stopped, as if the “Freeze” or “Cancel” button was hit.
- All hardkeys are disabled except the trackball, left and right trackball button and the power knob.
- The hardware is put into power save.

11.7.2 Enabling Screenlock

Screenlock has to be enabled before it can protect your system:

1. Press the [Utilities] hardkey.
2. Press S or click the [System] softkey, to invoke the System Setup Screen.
3. Click the “General” filing card.
4. Tag the “Screen Lock” checkbox (4) to enable Screenlock.

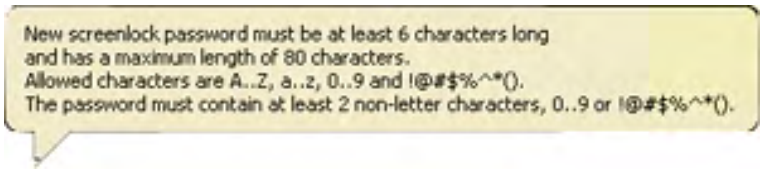
   Tag checkbox (5), if you want Screenlock to protect your system automatically when the screensaver starts.



5. When you enable Screenlock the first time you are prompted to enter a password.

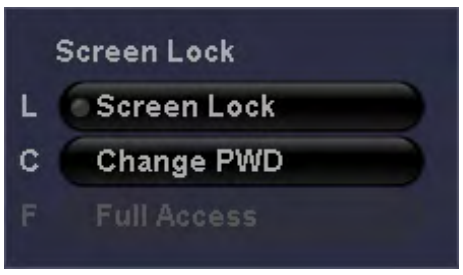


6. Enter the password and click [Save & Exit]. The rules, what is a valid password, appear in a bubble.


New screenlock password must be at least 6 characters long
and has a maximum length of 80 characters.
Allowed characters are A..Z, a..z, 0..9 and !@#$%^*().
The password must contain at least 2 non-letter characters, 0..9 or !@#$%^*().

7. Confirm that you want Screenlock enabled with [Save & Exit]

   You have just enabled Screenlock and the Utility menu has changed.



11.7.3 Screenlock options

There are three options.

1. [Screenlock]: Press [Screenlock] to activate the screenlock.
2. [Chg Password]: Click [Chg Password] if you want to change the screenlock password.
3. [Full Access]:This softkey is grayed during normal usage. It is only available in Emergency mode. When you want to regain full access to the system, click [Full Access].

11.7.4 Emergency Mode

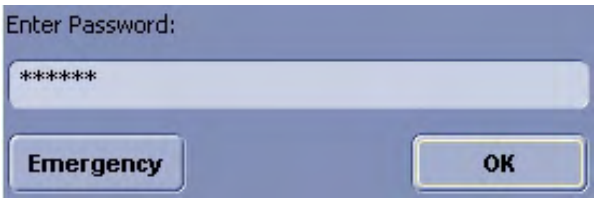
When screenlock is active, there are two possibilities to enter the system again. Firstly you can gain full access by typing in the password or secondly you can click the [Emergency] softkey to enter in Emergency Mode.



Emergency Mode allows you to scan a new patient and to save his/her data, but you will not have access to the last patient, previous exams or the worklist.



Click the [Full Access] softkey to leave Emergency Mode and obtain full access again. You will be prompted to enter your password.



Chapter 12

Generic Measurements

Describes measurement functions

Generic Measurements



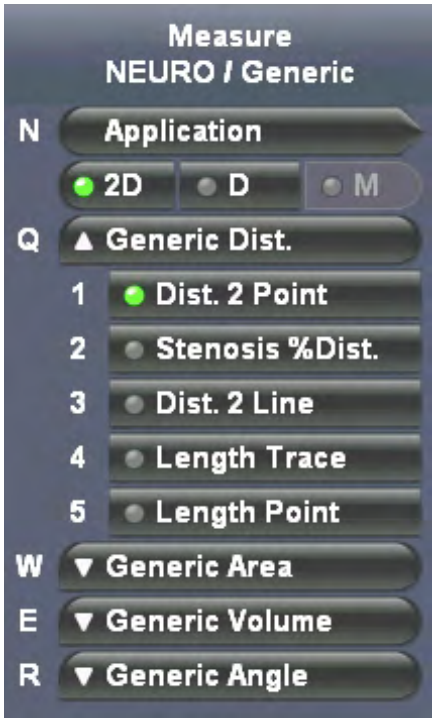
Positioning of measuring marks is done with the trackball.

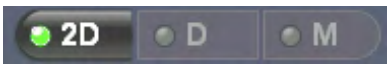
Basic Measurement - **Caliper** key (hard key)

By pressing the **[Caliper]** key the Basic Measurement function is switched on and a cursor appears in the frozen image area.

For description of Generic Measurement functionality review: Basic Operations 'Basic Operations' *on page 12-3*.

For Example: **2D+D Mode** (the active menu is for **2D** mode)





By means of these items, the mode can be changed and the corresponding measurements will be shown in the menu area on the screen.

- 2D Mode measurements '2D Mode Measurements' *on page 12-5*
- M Mode measurements 'M-Mode Measurements' *on page 12-12*
- D Mode measurements 'D-Mode Measurements' *on page 12-14*

Additional functions in the “Generic Measurement” menu:

- To Change the Measurement Applications 'To Change the Measurement Application' *on page 12-18*
- To Review the Generic Worksheet 'To Review the Generic Worksheet' *on page 12-19*

12.1 Basic Operations

Note *Measurements are possible in read mode only.*



By pressing the **[Caliper]** key on the control panel the Generic Measurement function is switched on. The menu area display depends on the acquisition mode and the “Generic” settings in the Measure Setup. For details, review: Measure & Calc 'Measure & Calc' *on page 17-4*

- Selection of the desired measurement marks is done with the navigation wheel or by pressing the corresponding keyboard shortcut.



Positioning of measuring marks is done with the trackball.



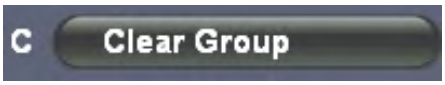
Entering and storage of measuring marks is done with the right or left trackball key [Set].



To change measuring marks before completion press the upper trackball key [Change]. If you want to readjust a traced line, press the upper trackball key [Undo] repeatedly.

The status area (on the lower right edge of the screen) shows the current function of the trackball.

To delete the results of the last measured item press the **[Backspace]** key on the keyboard.





To delete all measurement results of the selected “Study” from the monitor as well as from the corresponding Worksheet, select [Clear Group], or press the **[Delete]** key on the keyboard.



To erase measurement and arrows press the [Clear] key.





To exit the Generic Measurement program: - press the **[Exit]** key on the control panel, - or press the **[Caliper]** key on the control panel



Depending on the setting in the Measure Setup, also the **[Freeze]** key can be used for confirming the last measuring mark of the currently performed measurement.

- To get optimum resolution and accuracy from Doppler measurements, the [Angle] correction cursor must be positioned parallel to the vessel axis (in the area of the measuring volume).
- When the result display is full, (max. 4) the first measurement will be overwritten first.
- Except for Auto Trace measurements, all measurement results will be automatically included in the corresponding Generic Worksheet. To store Auto Trace measurement results, press the right or left trackball key [Set] previously.
- Depending on the **Application** setting and the adjustment in the Measure Setup:
  - RI and PI will be calculated using ED (End Diastole) or “MD” (Mid Diastole)

Note *Vdiastole = Vend-diastole or Vmin (depending on this selection)*

  - all previously set measuring marks are erased when starting a new scan (unfreeze -> Run mode), or the measurement results are kept on screen.
  - the Spectral Doppler envelope curve is performed with a continuous trace line or by setting points
  - the Doppler measuring results (according to the “Auto/Manual Trace” setting) are displayed after an Auto- or Manual Trace measurement

For further details, review: Application Parameters 'Application Parameters' *on page 17-17*

- Depending on the setting in the Measure Setup:
  - all previously set measuring marks are erased when activating cine mode, or the measurement results are kept on screen.
  - a new cursor appears to repeat the measurement, or not
  - the caliper (the last measuring mark of the current measurement) is fixed when pressing the **[Freeze]** key, the **[Print A]** or **[Print B]** keys, **[Save]** key, etc., or not

For further details, review: Global Parameters 'Global Parameters' *on page 17-19*

- Moreover, many display properties depend on the setting in the Measure Setup. For Example: cursor and font of measurement result is displayed in small, medium or large size

For further adjustments and detailed information review: Global Parameters 'Global Parameters' *on page 17-19*



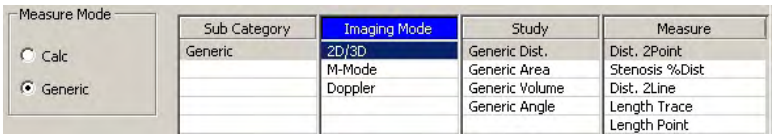
To change the current measurement application, select the [Application] item in the menu area. For further details, review: To Change the Measurement Application 'To Change the Measurement Application' *on page 12-18*.



To review, modify, print, etc. the Generic Work Sheet, select the [Worksheet] item in the menu area. For further details, review: To Review the Generic Work Sheet 'Generic Distance Measurements' *on page 12-6* 'To Review the Generic Worksheet' *on page 12-19*.

12.2 2D Mode Measurements

For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*



The “Factory” Generic Sub Category for 2D Imaging Mode (see image above) supports 4 Study types and following Measure methods:

Study	Measure
	Distance 2 Points 'Generic Area Measurements' *on page 12-7* 'Generic Distance Measurements' *on page 12-6* Distance 2 Lines 'Generic Distance Measurements' *on page 12-6* Length Trace 'Generic Distance Measurements' *on page 12-6* Length Point 'Generic Distance Measurements' *on page 12-6* Stenosis %Distance 'Generic Distance Measurements' *on page 12-6*
	Area Trace 'Generic Volume Measurement' *on page 12-9* 'Generic Area Measurements' *on page 12-7* Area Point 'Generic Area Measurements' *on page 12-7* Area 2 Distances 'Generic Area Measurements' *on page 12-7* Ellipse 'Generic Area Measurements' *on page 12-7* Stenosis %Area 'Generic Area Measurements' *on page 12-7*



3 Distances 'Generic Angle Measurement' *on page 12-11* 'Generic Volume Measurement' *on page 12-9* Ellipse 'Generic Volume Measurement' *on page 12-9* 1 Distance + Ellipse 'Generic Volume Measurement' *on page 12-9* 1 Distance 'Generic Volume Measurement' *on page 12-9* Multiplane 'Generic Volume Measurement' *on page 12-9*



Angle 3 Points 'Generic Angle Measurement' *on page 12-11* Angle 2 Lines 'Generic Angle Measurement' *on page 12-11*

12.2.1 Generic Distance Measurements



12.2.1.1 Distance 2 Points

1. To measure the distance between two points, select the [Dist. 2Point] item in the menu area. A cursor appears on the screen.
2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.2.1.2 Distance 2 Lines

1. To measure the distance between two lines, select the [Dist. 2Line] item in the menu area. A line appears on the screen.
2. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key [Change].*

3. Move the trackball to adjust the angle and then press [Set] again. A second line (parallel to the first one) appears.
4. Move this line using the trackball to the end point of the measurement and then press [Set].

12.2.1.3 Length Trace

1. To measure the distance between two points using trace, select the [Length Trace] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end and press the [Set] key again to fix the mark.

12.2.1.4 Length Point

1. To measure the distance between several points (as much as desired), select the [Length Point] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker.
3. Move the trackball again to adjust the next line between two points and then press [Set] again.

Note *To re-adjust a line, press the upper trackball key [Undo] repeatedly.*

4. Set as much points as required in the same manner.
5. To finish the measurement and to display the result, press the [Set] key once again.

12.2.1.5 Stenosis %Distance

1. To measure a Stenosis, select the [Stenosis %Dist] item in the menu area. A cursor appears on the screen.
2. Perform the measurement of the outer distance of the stenosis using the trackball and the right or left trackball key [Set]. A second cursor appears.
3. Perform the measurement of the inner distance of the stenosis and press the [Set] key.

Remark:

The results (such as outer and inner distance and the Stenosis %) appear automatically.

12.2.2 Generic Area Measurements



12.2.2.1 Area Trace

1. To measure circumference and area using trace, select the [Area Trace] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move the second cursor around the shape to be measured.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

4. When the second cursor is near the initial cursor position, or if you press the right or left trackball key [Set] again the trace is automatically completed by a straight line.

12.2.2.2 Area Point

1. To measure circumference and area by setting several points (as much as desired), select the [Area Point] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start of the measurement and press the right or left trackball key [Set] to fix the marker.
3. Move the trackball again to adjust the next line between two points and then press [Set] again.

Note *To re-adjust a line, press the upper trackball key [Undo] repeatedly.*

4. Set as much points as necessary, around the shape to be measured.

When you press the [Set] key once again, a straight line automatically completes the trace.

12.2.2.3 Area 2 Distances

1. To measure circumference and area of an ovoid using 2 distances, select the [Area 2 Dist] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move the second cursor to the end point of the first measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Measure the second distance as described above.

12.2.2.4 Ellipse

1. To measure circumference and area of an ovoid using an ellipse, select the [Ellipse] item in the menu area. A cursor appears on the screen.
2. Position the cursor on the perimeter of the shape to be measured. Press the right or left trackball key [Set] to fix the mark. A second cursor appears.
3. Move the second cursor (to form an appropriate ellipse) and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set].

12.2.2.5 Stenosis %Area

The measurement procedure is the same than the measurement of the Generic Area - Ellipse 'Generic Measurements' *on page 12-12* 'Ellipse' *on page 12-8* 'Ellipse' *on page 12-8*.

1. To measure a Stenosis, select the [Stenosis %Area] item in the menu area. A cursor appears on the screen.
2. Perform the measurement of the outer area of the stenosis using the trackball and the right or left trackball key [Set]. A second cursor appears.
3. Perform the measurement of the inner area of the stenosis and press the [Set] key.

Remark:

The results (such as outer and inner area and the Stenosis %) appear automatically.

12.2.3 Generic Volume Measurement



12.2.3.1 2 Distances

1. To measure volume of an ovoid using three distances, select the [3 Dist] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move the second cursor to the end point of the first measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Measure the second distance as described above.

Note

- *When using single image mode, measure the two distances. Press **[Freeze]** to return to scan mode and scan the second image. Press **[Freeze]** again. A new cursor for the third distance measurement appears.*

  If you have scanned the second image in Dual mode previously, you can measure the third distance within this second (half) image.

5. Perform the measurement of the third distance in the same manner.

12.2.3.2 Ellipse

The measurement procedure is the same than the measurement of the Generic Area - Ellipse.

Remark:

After the measurement, the volume of the ellipse is displayed.

12.2.3.3 1 Distance + Ellipse

1. To measure volume of an ovoid using one distance and ellipse, select the [1 Dist Ellipse] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the distance measurement and press the right or left trackball key [Set]. A second cursor appears.
3. Move the second cursor to the end point of the distance measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

- *When using single image mode, measure the two distances. Press **[Freeze]** to return to scan mode and scan the second image. Press **[Freeze]** again. A new cursor for the ellipse measurement appears.*
- *If you have scanned the second image in Dual mode previously, you can measure the ellipse within this second (half) image.*

4. Move the cursor to the start point of the ellipse measurement and press the right or left trackball key [Set]. A second cursor appears.
5. Move the second cursor (to form an appropriate ellipse) and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change].*

6. Adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set].

12.2.3.4 1 Distance

To measure volume of a globe-like volume using one distance, select the [1 Dist] item in the menu area. A cursor appears on the screen.

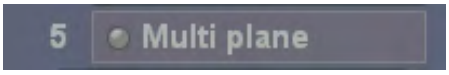
1. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key to fix the marker. A second cursor appears.
2. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.2.3.5 Multiplane

This measuring program allows for volume determination of any organ, which was stored by a volume scan. Several parallel planes are laid through the organ and the areas of these planes are determined. A measuring program calculates the volume from the measured areas and the distance between the areas. The larger the number of areas, the more exact the volume calculation result will be.

Condition: a stored volume scan (Sectional Planes view).



To measure volume using the Multiplane method in 3D Mode:

1. Select the reference image in which the measurement is to be performed. (A, B or C)
2. Select the [Multiplane] item. The menu area changes to the 3D MultiPlane menu.

Note *The first section should be set at the edge of the measured object.*

3. Measure the area (proceed as for area measurement). Position the start dot of the area to be surrounded with the trackball and store it. Surround the area with the trackball, then press the right or left trackball key [Set].

   The area is calculated and displayed. The area may even be "zero" (dot at the edge).
4. Press the [Set] key **twice**!
5. Select the next parallel section with the [Ref. Slice] digipot and measure the area.
6. Repeat 4. and 5. until the edge of the measured object is reached.

Remarks:

- The contour of the measured area is not erased if a new section is adjusted. From the deviation in the new section it is possible to decide whether a new area should be marked. With new marking the old contour is erased.



- To erase results, select the [Init] item.

12.2.4 Generic Angle Measurement



12.2.4.1 Angle 3 Point

1. To measure the angle by setting 3 points, select the [Angle 3 Point] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the angle measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move this cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the each distance measurement. This alternates the control from one cursor to the other.*

4. Move the third cursor to the end point of the angle measurement.

Remark:

The angle between the two lines is displayed.

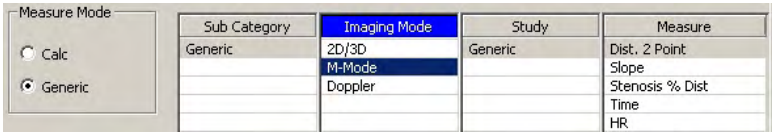
12.2.4.2 Angle 2 Line

1. To measure the angle between to lines, select the [Angle 2 Line] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the angle measurement and press the right or left trackball key [Set] to fix the marker. A horizontal line appears.
3. By means of the trackball, rotate the line to adjust the angle and then press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.3 M-Mode Measurements

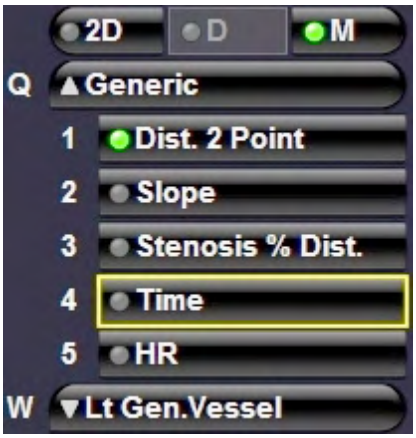
For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*



The “Factory” Generic Sub Category for M-Mode (see image above) supports 1 Study type and following Measure methods:

Study	Measure
	Distance 2 Points 'Generic Measurements' *on page 12-15* 'Generic Distance Measurements' *on page 12-6* 'Generic Measurements' *on page 12-12* Slope 'Generic Measurements' *on page 12-12)* Time 'Generic Measurements' *on page 12-12)* Stenosis %Distance 'Generic Distance Measurements' *on page 12-6* 'Generic Measurements' *on page 12-12* HR (Heart Rate) 'Generic Measurements' *on page 12-12*

12.3.1 Generic Measurements



12.3.1.1 Distance 2 Points

This measures the vertical distance (tissue depth) between two points. The measurement procedure is the same as the distance measurement in 2D Mode. review: Distance 2 Points ('Generic Distance Measurements' *on page 12-6)*.

12.3.1.2 Slope

1. To measure the time and slope, select the [Slope] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move this cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.3.1.3 Stenosis %Distance

This measures the vertical distance (tissue depth) between two points. The measurement procedure is the same than the measurement in 2D Mode. review: Stenosis %Distance *)*.

12.3.1.4 Time

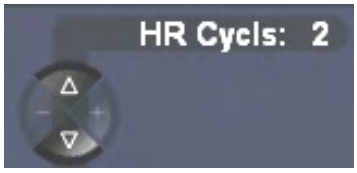
1. To measure a horizontal time interval, select the [Time] item in the menu area. A line appears on the screen.
2. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key. A second line (parallel to the first one) appears.*

3. Move this line using the trackball to the end point of the measurement and then press [Set].

12.3.1.5 HR (Heart Rate)

1. To measure the Heart Rate, select the [HR] item in the menu area. A line appears on the screen.
2. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.
3. Move the second line to the end point of the period.



4. Select the number of heart rate cycles for measurement using this digipot.
5. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

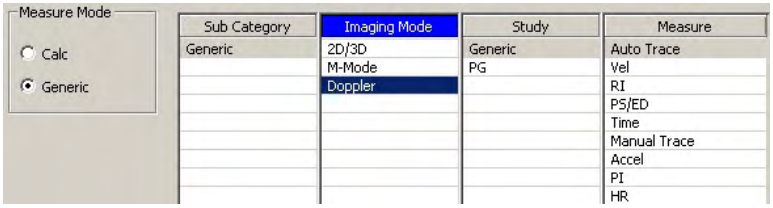
12.3.2 Generic Vessel

Default measure items include Vessel Area, Vessel Diam., Stenosis Area, Stenosis Diam., IMT and Flow Diam. For information on how to perfrom these measurements read:

- 'Abdomen Calculations in 2D Mode' *on page 13-13*

12.4 D-Mode Measurements

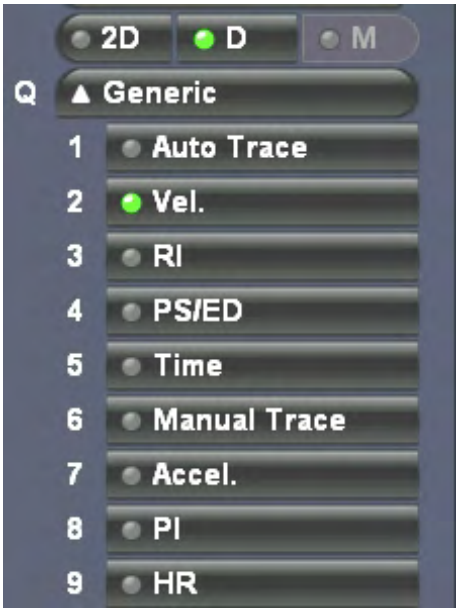
For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*



The “Factory” Generic Sub Category for Doppler Mode (see image above) supports 2 Study types and following Measure methods:

Study	Measure
	Auto Trace 'PG (Pressure Gradient) Measurements' *on page 12-17* 'Generic Measurements' *on page 12-15* Manual Trace 'Generic Measurements' *on page 12-15)* Velocity 'Generic Measurements' *on page 12-15* Acceleration 'Generic Measurements' *on page 12-15)* RI (Resistivity Index) 'Generic Measurements' *on page 12-15)* PI (Pulsatility Index) 'Generic Measurements' *on page 12-15) PS/ED (Peak Systole/End Diastole Ratio)* 'Generic Measurements' *on page 12-15)* Time 'Generic Measurements' *on page 12-15* HR (Heart Rate) 'Generic Measurements' *on page 12-15*
	PG max (Pressure Gradient maximum) 'PG (Pressure Gradient) Measurements' *on page 12-17* PG mean (Pressure Gradient mean) 'PG (Pressure Gradient) Measurements' *on page 12-17*

12.4.1 Generic Measurements



12.4.1.1 Auto Trace

1. Select the Auto Trace item from the menu area to trace the Doppler spectrum and display the results as defined in the Measure Setup.



2. Select the sensitivity of the envelope curve (to eliminate artifacts).



3. Select the Trace Mode channel of the envelope curve (upper, both, lower).

4. If necessary, select the [Angle] and the [Baseline].



A green line appears at the left of the spectrum. Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line. A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].

The status area (on the lower right edge of the screen) shows the current function of the trackball.

5. Press the right or left trackball key [Set] to finish the measurement.

Remark:

To select the Doppler measuring results, which should be displayed after an Auto Trace measurement, review: Application Parameters 'Application Parameters' *on page 17-17 .*

The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

12.4.1.2 Manual Trace

1. To trace the Doppler spectrum manually and to display the results (according to the “Auto Trace” setting in the Measure Setup), select the [Manual Trace] item in the menu area. A cursor appears on the Doppler spectrum.
2. Move the cursor to the start point of the period and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end of the period and press the [Set] key again to fix the mark.

Remark:

To select the Doppler measuring results, which should be displayed after the measurement (= “Auto/Manual Trace”) and to select if the envelope curve will be performed with a continuous trace line or by setting points (= “Manual Trace Mode”), review: Application Parameters 'Application Parameters' *on page 17-17 .*

12.4.1.3 Velocity

1. To measure the velocity in Spectral-Doppler mode, select the [Vel] item in the menu area. A horizontal line appears on the screen.
2. Move the line to the velocity point desired and press the right or left trackball key [Set].

12.4.1.4 Acceleration

1. To measure the accelerated velocity in Spectral-Doppler mode, select the [Accel] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move this cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

12.4.1.5 RI (Resistivity Index)

1. To measure the resistivity index as well as the peak-systolic and end-diastolic velocity in Spectral-Doppler mode, select the [RI] item in the menu area. A horizontal line appears on the screen.
2. Move the line to the peak of the systole and press the right or left trackball key [Set]. A second line appears.
3. Move the second line to the end of the diastole and press [Set] again.

12.4.1.6 PI (Pulsatility Index)

1. To measure the pulsatility index, the time averaged maximum velocity as well as the peak-systolic and end-diastolic velocity in Spectral-Doppler mode, select the [PI] item in the menu area. A cursor appears on the screen.

2. Move the cursor to the beginning of the waveform (Vmax) and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end of the waveform (Vd) and press the [Set] key again to fix the mark.

12.4.1.7 PS/ED (Peak Systole/End Diastole Ratio)

1. To calculate the Peak Systole/End Diastole ratio in Spectral-Doppler mode, select the [PS/ED] item in the menu area. A horizontal line appears on the screen.
2. Move the line to the peak of the systole and press the right or left trackball key [Set]. A second line appears.
3. Move the second line to the end of the diastole and press [Set] again.

12.4.1.8 Time

The measurement procedure of the time in Spectal-Doppler mode is the same than the measurement in M mode. review: Time 'Generic Measurements' *on page 12-12*.

12.4.1.9 HR (Heart Rate)

The measurement procedure is the same than the measurement in M mode. review: HR (Heart Rate) 'Generic Measurements' *on page 12-12*.

12.4.2 PG (Pressure Gradient) Measurements



12.4.2.1 PG max (Pressure Gradient maximum)

1. To measure the maximum velocity and the maximum pressure gradient in Spectral-Doppler mode, select the [PG max] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the pressure gradient point and press the right or left trackball key [Set] to fix the marker.

12.4.2.2 PG mean (Pressure Gradient mean)

1. To measure the mean pressure gradient in Spectral-Doppler mode, select the [PG mean] item in the menu area. A cursor appears on the screen.
2. Move the cursor to the beginning of the waveform (Vmax) and press the right or left trackball key [Set] to fix the marker. Begin trace.

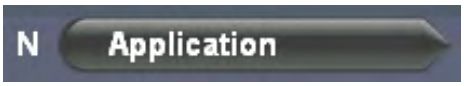
Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

3. Trace to the end of the waveform (Vd) and press the [Set] key again to fix the mark.

12.4.3 Generic Vessel

For more information see 'Generic Vessel' *on page 12-14.*

12.5 To Change the Measurement Application

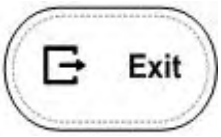


1. Select this item in the menu area to change the currently used measurement application.



2. Select another application.

Note *If desired, change also the Preset and Sub Category.*



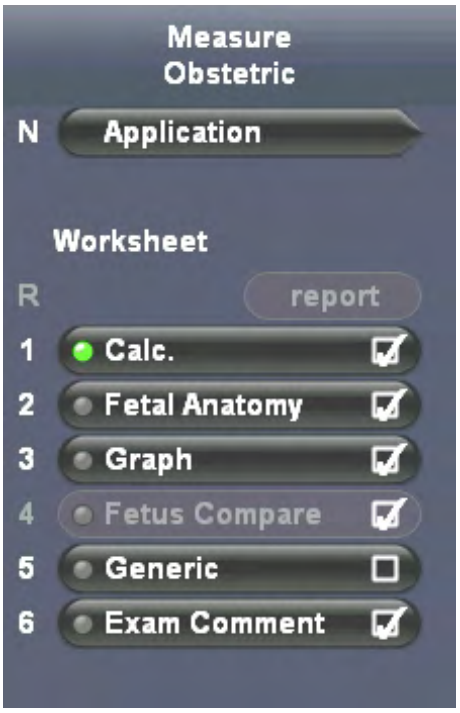
3. Return to the Generic Measurement menu.

When changing to another measurement application, the main application (chosen in the “Probe Selection” menu) does not change! When a "main" application in the “Probe Selection” menu is selected, the Generic measurement menu is automatically set (changed) to this application.

12.6 To Review the Generic Worksheet



1. Press the [Report] key to review the current application worksheet.



The display of the worksheet depends on the currently selected measurement application (e.g., Worksheet Obstetric).

2. Select the [Generic] item to review all previously calculated generic measurement results.



By means of this Menu control, additional worksheet pages can be selected.

For further descriptions, possible adjustments and functions, review: Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.



3. Return to the Generic Measurement menu.

12.7 Accuracy of measurements

The possible accuracy of geometric, flow speed or other measurements with this ultrasound system is a result of various parameters that shall be equally considered. The used images shall be optimized and scaled to provide the best view of the examined structures. To ensure this, the correct choice of the ultrasound probe and imaging mode for a certain application plays an essential role.

Despite the high theoretical accuracy of the scan geometry and the measuring system of the Voluson ultrasound system, it is important to be aware of increased inaccuracies caused by the ultrasound beam travelling through the inhomogeneous human tissue. Therefore differences between operators shall be minimized by standardization of procedures.

For more information see *Basic Service Manual*.

Chapter 13

Calculations and Patient Worksheets (Reports)

Describes the calculations and the handling of the patient worksheets

Calculations and Patient Worksheets (Reports)

The Calculation function supports calculation packages for following applications:

Abdomen Calculations	'Abdomen Calculations' *on page 13-12*
Small Parts Calculations	'Small Parts Calculations' *on page 13-19*
Obstetric Calculations	'Obstetric Calculations' *on page 13-22*
Cardiology Calculations	'Cardiac Calculations' *on page 13-37*
Urology Calculations	'Urology Calculations' *on page 13-51*
Vascular Calculations	'Vascular Calculations' *on page 13-53*
Gynecology Calculations	'Gynecology Calculations' *on page 13-56*
Pediatric Calculations	'Pediatric Calculations' *on page 13-59*
Neurology Calculation	'Neurology Calculations' *on page 13-61*
Musculoskeletal (MSK) Calculations	'Musculoskeletal (MSK) Calculations' *on page 13-64*



To change the current measurement application (and/or the Sub Category), select this item in the menu area.



For Basic Calculation Functionality, review: 'Basic Calculation Functionality' *on page 13-2)* 'Abdomen - Worksheet' *on page 13-19*

The system supports following application-oriented Patient Worksheets (Reports):

Abdomen - Worksheet Small Parts - Worksheet Obstetric - Worksheet Cardiology - Worksheet Urology - Worksheet Vascular - Worksheet Gynecology - Worksheet Pediatric - Worksheet Neurology - Worksheet Musculoskeletal (MSK) Calculations

'Small Parts - Worksheet' *on page 13-21* 'Obstetric - Worksheet' *on page 13-31* 'Cardiology - Worksheet' *on page 13-50* 'Urology - Worksheet' *on page 13-53* 'Vascular - Worksheet' *on page 13-55* 'Gynecology - Worksheet' *on page 13-58* 'Pediatric - Worksheet' *on page 13-61* 'Neurology - Worksheet' *on page 13-63* 'Musculoskeletal (MSK) Calculations' *on page 13-64)*



For Basic Patient Worksheet Functions, review: 'Basic Patient Worksheet Functions' *on page 13-5*

13.1 Basic Calculation Functionality



Calculation key (hard key)

By pressing on the **[Calc]** key the Calculation function is switched on and a caliper appears within the frozen image area.

Note *Measurements are possible in read mode only.*

- Selection of the desired measurement is done with the navigation wheel or by pressing the corresponding keyboard shortcut.



Positioning of measuring marks is done with the trackball.

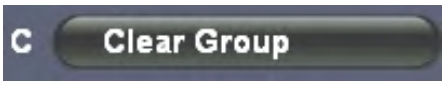


Entering and storage of measuring marks is done with the right/ left trackball key [Set].



To change measuring marks before completion press the upper trackball key [Change]. If you want to readjust a traced line, press the upper trackball key repeatedly [Undo].

To delete the results of the last measured item press the **[Backspace]** key on the keyboard.



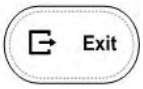


To delete all measurement results of the selected “Study” from the monitor as well as from the corresponding Worksheet, select [Clear Group], or press the **[Delete]** key on the keyboard.



To erase all measurements and arrows pressthe [Clear] key.

Note *It is possible to configure the Voluson® i to automatically clear measurements and annotations on Unfreeze.* 'User Settings' *on page 16-8*



To exit the Calculation program: - press the **[Exit]** key on the control panel, - or press the **[Calc]** key on the control panel





Depending on the setting in the Measure Setup, also the **[Freeze]** key can be used for confirming the last measuring mark of the currently performed measurement.

- To get optimum resolution and accuracy from Doppler measurements, the [Angle] correction cursor must be positioned parallel to the vessel axis (in the area of the measuring volume).
- When the result display is full, (max. 4) the first measurement will be overwritten first.

- If more measurements are performed the actual measurement will be placed in the lower right corner. The previous measurements are displayed above (in successive order, like a shift register).
- Except for Auto Trace measurements, all measurement results will be automatically included in the corresponding Worksheet. To store Auto Trace measurement results, press the right or left trackball key [Set] previously.
- Depending on the **Application** setting and the adjustment in the Measure Setup:
  - RI and PI will be calculated using ED (End Diastole) or “MD” (Mid Diastole)

Note *Vdiastole = Vend-diastole or Vmin (depending on this selection)*

  - all previously set measuring marks are erased when starting a new scan (unfreeze -> Run mode), or the measurement results are kept on screen.
  - the Spectral Doppler envelope curve is performed with a continuous trace line or by setting points
  - the Doppler measuring results (according to the “Auto/Manual Trace” setting) are displayed after an Auto- or Manual Trace measurement (Setting will be ignored in Cardiac calculations).
  - measurement items (e.g., BPD) will be shown with our without the Author’s Name.

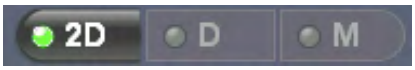
For further details, review: Application Parameters 'Application Parameters' *on page 17-17*

- Depending on the setting in the Measure Setup:
  - all previously set measuring marks are erased when activating cine mode, or the measurement results are kept on screen.
  - a new cursor appears to repeat the measurement, or not
  - the caliper (the last measuring mark of the current measurement) is fixed when pressing the **[Freeze]** key, the **[Print A]** or **[Print B]** keys, **[Save]** key, etc., or not

For further details, review: Global Parameters 'Global Parameters' *on page 17-19*

- Moreover, many display properties depend on the setting in the Measure Setup. For Example: cursor and font of measurement result is displayed in small, medium or large size

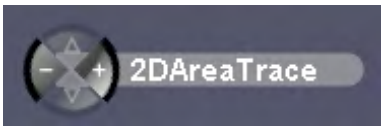
For further adjustments and detailed information review: Global Parameters 'Global Parameters' *on page 17-19*



By means of these items, the mode can be changed and the corresponding measurements will be shown in the menu area on the screen.



To review, modify, print, etc. the “application dependent” Patient Worksheet, press the [Report] key on the control panel. For details, review: Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.



In certain measurements the measurement method (e.g. trace, ellipse, spline,...) can be toggled by means of the menu soft buttons.



Using this Menu control, the side to be measured can be changed. (e.g., to change from the left to the right Kidney).

13.2 Basic Patient Worksheet Functions



All calculation results are recorded in the application-dependent patient worksheets. By pressing the **[Report]** key on the control panel.(Always start with the first page of the Patient worksheet)

- To view a Worksheet 'To view a Worksheet' *on page 13-5*
- To edit a Worksheet 'To edit a Worksheet' *on page 13-6*
- To change the Application 'To change the Application' *on page 13-7*
- Exam Comment 'Exam Comment' *on page 13-7*
- To transfer a Worksheet 'To transfer a Worksheet' *on page 13-8*
- To view previous Worksheets 'To view previous Worksheets' *on page 13-8*
- To print a Report 'To print a Report' *on page 13-9*

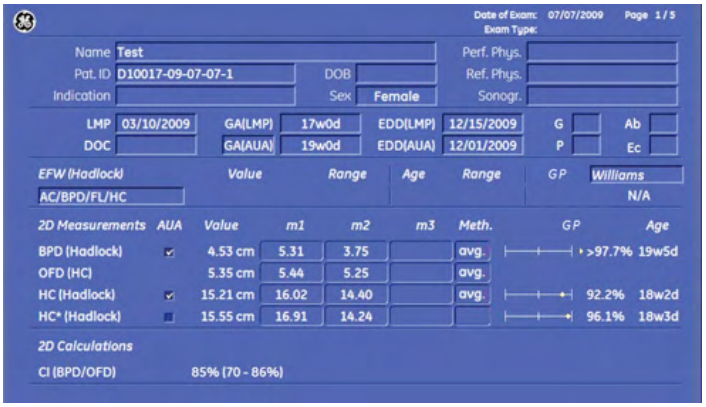


The Obstetric Worksheet provides some additional functions. For further details review: Obstetric - Worksheet 'Obstetric - Worksheet' *on page 13-31*.

13.2.1 To view a Worksheet

Press the **[Report]** key on the control panel, or select the [Worksheet] item in the “Calculation menu” to view the patient worksheet that contains the result of calculations.

The worksheet appears as follows (e.g., Obstetrics – summary report “Calc”).



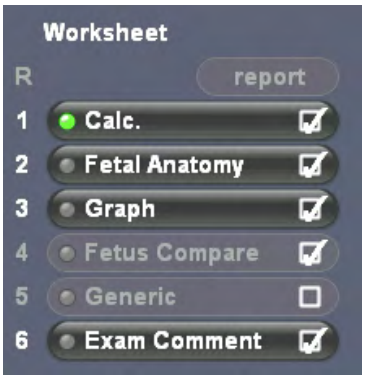


With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

Note *It is now possible to switch between Gyn and OB worksheets (if both worksheets exists).*

Review: First Trimester OB in application GYN 'Measure & Calc' *on page 17-4*.

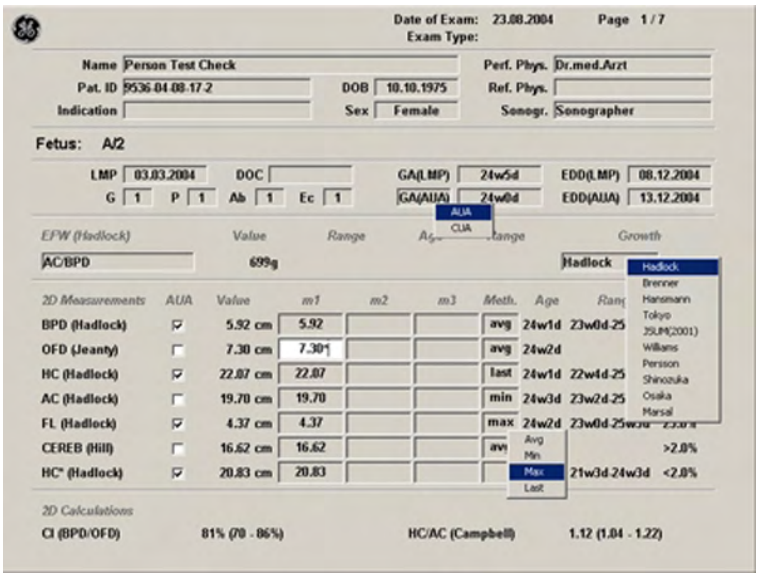


Use following items to switch between different summary reports.

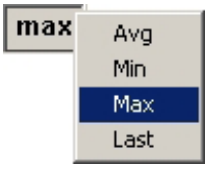
Note *Display depends on the selected Application.*

13.2.2 To edit a Worksheet

Any stored measurements in a patient worksheet can be edited.

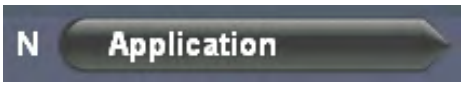


Move the cursor to the desired field, press the right or left trackball key [Set] and type in the changes. The edited values are marked with an asterisk (***** next to the changed value).



Additionally some parameters or settings can be changes when clicking into the specific field on the worklist page. For example: **Method**: Average, Minimum, Maximum or last

13.2.3 To change the Application



1. To change the application of the worksheet, select this item in the menu area.
2. Select another application and then press **[Exit]**.

13.2.4 Exam Comment



Select this item, to view the “Exam Comment” summary report, to enter a comment using the keyboard, or to enter a previous defined comment by selecting the [Comment A], [Comment B] or [Comment C] item in the menu area.



If a comment is already saved:

- type in the comment desired using the alphanumeric keyboard, or
- select the [Comment A], [Comment B] or [Comment C] item to enter a previous defined comment

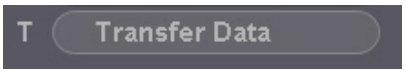
If no comment is saved, and you want to save one:

- Type in the comment desired using the alphanumeric keyboard

- Select the [Save as] item in the menu area.
- Save the entered comment as [Comment A], [Comment B] or [Comment C].
- Press **[Exit]**.

To delete all entered comments, select the [Delete] item in the menu area.

13.2.5 To transfer a Worksheet



Click this item in the menu area to transfer the patient worksheet data to the selected IP-address, or to a PC that is connected via serial port.

Note *If a Structured Report Server exists, the data is transferred using DICOM Structured Reporting, independent of whether there are other report servers (network, serial) available.*

Note *The [Transfer Data] item can only be selected if a "Service: REPORT" destination is specified in the System Setup; review:* *To specify a DICOM Address* 'To Specify a DICOM Address' *on page 16-27.*

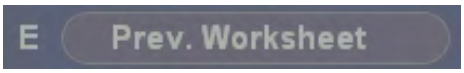
Note *Receiving Report Data*

An example for software that can receive and store reports is the "PIA" documentation system for medical diagnostics and digital image archiving from "ViewPoint". (www.viewpoint-online.com)

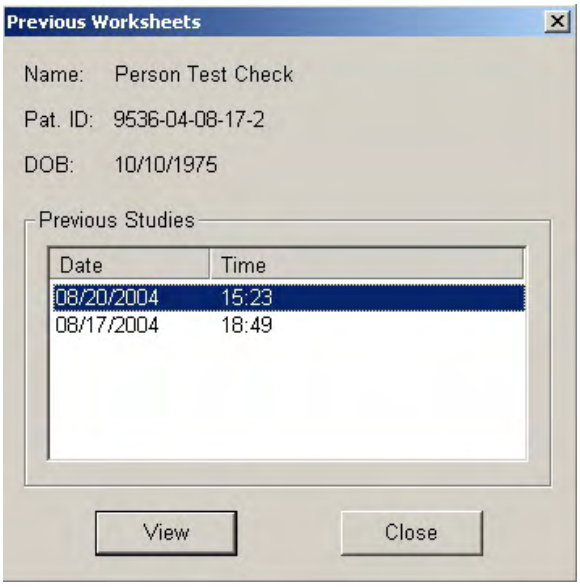
Note *With this software version, it is ONLY possible to transfer an Obstetrics and Gynecology worksheet!*

13.2.6 To view previous Worksheets

For different exams of the same patient, all previous worksheets can be viewed by using the same ID.



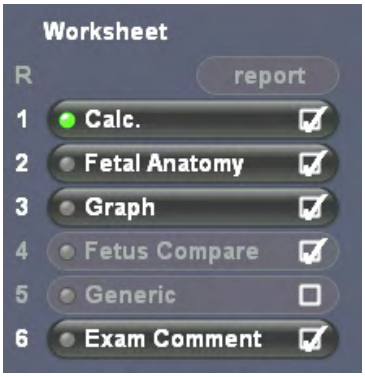
Select this item in the menu area to view all existing patient worksheets of the currently selected Measurement Application.



1. Select the desired Date.
2. Click the [View] button to show the selected patient worksheet on the screen.

13.2.7 To print a Report

1. Select the “Summary report” pages for the printout.



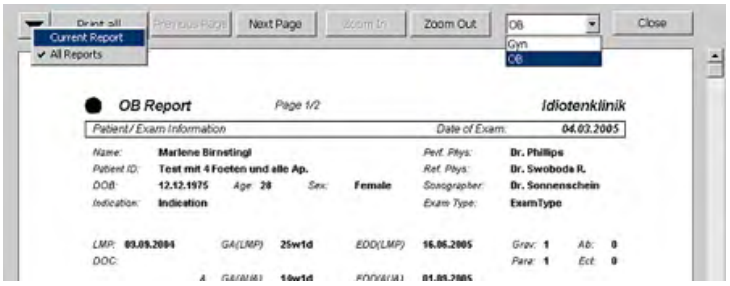
Note *Display depends on selected Application.*

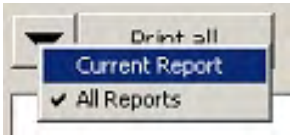
The **[R]** marks each summary report that is included in the printout report. To exclude them from the printout, de-select the [Include in Report] item in the menu area.



2. To verify your selection and to preview the report pages that will be printed, select this item in the menu area.

Following window appears:





Select whether to print only the current report or all available reports (all applications). Selection also affects “Print” Button in Worksheet Menu.

Print all/Print	Print all available reports or just the currently displayed report. Depends on setting.
Previous Page	Display previous report page.
Next Page	Display next report page.
Zoom In	Zoom In on the displayed Report.
Zoom Out	Zoom Out of the displayed Report.
Application	Select the report of which application to display.
Close	Close Print Preview Window without printing.

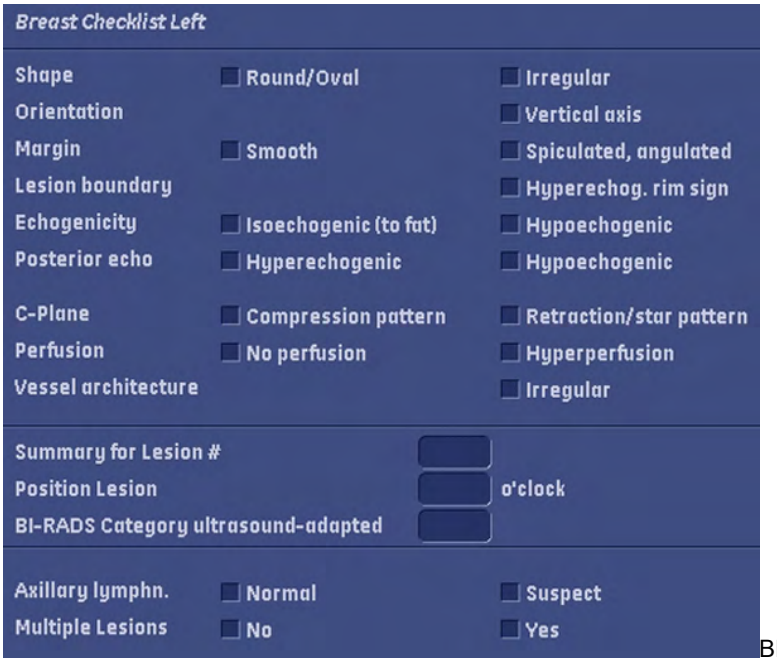


3. Print the patient report of the currently selected Measurement Application on the Report printer selected in the System Setup.

To select the desired Report printer review: 'Printer configuration' *on page 15-4*.

13.2.8 Special worksheet pages

13.2.8.1 BI-RADS®



BI-RADS® is a quality assurance guide designed by the American College of Radiology to standardize breast imaging reporting and facilitate outcome monitoring. There are no measurements displayed in this worksheet page. You can enter a BI-RADS category and check several items of a breast exam. Use the **Menu soft buttons** to switch sides in order to enter data for the left and right breast.

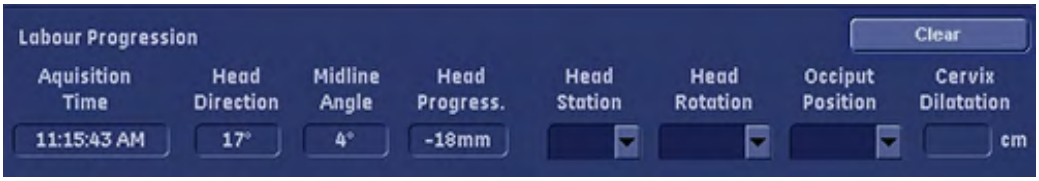
13.2.8.2 SonoAVC follicle



After the follicle table has been added to the Report (via the ***Add to Report*** button - see 'SonoAVC follicle' *on page 10-42*) it can be reviewed in the GYN reports' respective worksheet.

See 'SonoAVC follicle' *on page 10-42* for further info about this software feature.

13.2.8.3 SonoVCAD labor



The SonoVCAD labor section of the CALC worksheet consists of calculated values and form fields for manual input. Everytime a measurement is acquired with SonoVCAD labor a new line will be added to the worksheet page. Press the **Clear** button to delete the measurement history.

See 'SonoVCAD labor' *on page 10-68* for further info about this software feature.

13.3 Abdomen Calculations

Application “Abdomen”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Abdomen Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.3.1 Items of Abdomen Calculations

The items of abdomen calculations in each mode are as follows:

2D/3D Mode:	Liver, Gallbladder, Pancreas, Spleen, Left/Right Kidney, Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Vessel
M Mode:	Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Vessel
Doppler Mode:	Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Vessel, Portal Vein

13.3.2 Before starting Abdomen Calculations



1. Press the **[Patient]** key on the control panel, select the [ABD] page and enter all patient information for Abdomen calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Appl.]** key on the control panel, and change it to Abdomen. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.3.3 Abdomen Calculations in 2D Mode

- Distance Measurements 'Distance Measurements' *on page 13-13)* (like Length, Height, etc.)
- Vessel Area/Vessel Diameter 'Vessel Area/Vessel Diameter' *on page 13-13*
- Stenosis Area/Stenosis Diameter 'Stenosis Area/Stenosis Diameter' *on page 13-14*

13.3.3.1 Distance Measurements

To measure a distance in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Liver].
3. Select the desired measurement parameter. For example: select [Length].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

13.3.3.2 Vessel Area/Vessel Diameter

To measure the Vessel Area or the Vessel Diameter in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. Select the appropriate measurement parameter [Vessel Area] or [Vessel Diameter].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

6. **Only** if [Vessel Area] is selected, adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set] again.

13.3.3.3 Stenosis Area/Stenosis Diameter

To calculate the Stenosis Area or the Stenosis Diameter in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Liver].
3. Select the appropriate measurement parameter [Height] or [Portal V. Diam.].
4. To measure the outer area (resp. outer diameter), use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker.
5. Move the second cursor to the second point of the measurement and press [Set] again.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

6. Perform the measurement of the inner area (resp. diameter) in the same manner as described above.

The results (such as outer and inner area resp. diameter and the Stenosis %) appear automatically.

13.3.4 Abdomen Calculations in M Mode

- Vessel Diameter 'Vessel Diameter' *on page 13-15*
- Stenosis Diameter 'Stenosis Diameter' *on page 13-15*
- Time 'Time' *on page 13-15*

- HR (Heart Rate) 'HR (Heart Rate)' *on page 13-15*

13.3.4.1 Vessel Diameter

To measure the Vessel Diameter in M Mode:

1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. Select the measurement parameter [Vessel Diameter].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

13.3.4.2 Stenosis Diameter

To calculate the Stenosis Diameter in M Mode:

1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. Select the measurement parameter [Stenosis Diameter].
4. To measure the outer diameter, use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker.
5. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6. Perform the measurement of the inner diameter in the same manner as described above.

The results (such as outer and inner diameter and the Stenosis %) appear automatically.

13.3.4.3 Time

To measure the Time in M Mode:

1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. To measure a horizontal time interval, touch the [Time] key. A line appears in the screen.
4. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key. A second line (parallel to the first one) appears.*

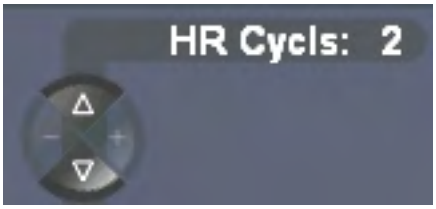
5. Move this line using the trackball to the end point of the measurement and then press [Set].

13.3.4.4 HR (Heart Rate)

To measure the Heart Rate (HR) in M Mode:



1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. Select the [HR] item in the menu area. A line appears on the screen.
4. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.



5. Select the number of heart rate cycles necessary for measurement with the corresponding digipot.
6. Move the second line to the end point of the period (according to the selected number of heart rate cycles to be measured).
7. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

13.3.5 Abdomen Calculations in Spectral-Doppler Mode

There are many possibilities to measure different vessels in Spectral-Doppler mode:

- Auto Trace 'Auto Trace' *on page 13-17*
- Manual Trace 'Manual Trace' *on page 13-17*
- Measurement of Each Item 'Measurement of Each Item' *on page 13-18*
- Measurement of PSV/EDV RI+SD 'Measurement of PSV/EDV RI+SD' *on page 13-18*
- Time 'Time' *on page 13-18*
- HR (Heart Rate) 'HR (Heart Rate)' *on page 13-18*

13.3.5.1 Auto Trace



1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.
2. Select the desired measurement item and then select [Auto Trace]. The Doppler spectrum is traced automatically and the results are displayed.



3. Select the sensitivity of the envelope curve (to eliminate artifacts).



4. Select the Trace Mode channel of the envelope curve (upper, both, lower).
5. If necessary, adjust the [Angle] and the [Baseline].



A green line appears at the left of the spectrum. Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line. A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].

6. Press the right or left trackball key [Set] to finish the measurement.

Remark:

To select the Doppler measuring results, which should be displayed after an Auto Trace measurement, review: Application Parameters 'Application Parameters' *on page 17-17 .*

The determination of the envelope curve requires a clear and low-noise recording of the Doppler spectrum. Otherwise the reliability of the displayed measurement results may not be ensured!

13.3.5.2 Manual Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.
2. Select the desired measurement item and then select [Manual Trace]. A cursor appears on the Doppler spectrum.
3. Move the cursor to the start point of the period and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

4. Trace to the end of the period and press the [Set] key again to fix the mark.

Remark:

To select the Doppler measuring results, which should be displayed after the measurement (= “Auto/Manual Trace”) and to select if the envelope curve will be performed with a continuous trace line or by setting points (= “Manual Trace Mode”), review: Application Parameters 'Application Parameters' *on page 17-17 .*

13.3.5.3 Measurement of Each Item

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.
2. Select the desired measurement item and then select the [PS], [ED], [RI] or [PI] key. A cursor appears on the Doppler spectrum.
3. Perform the measurement using the right or left trackball key [Set].

13.3.5.4 Measurement of PSV/EDV RI+SD

1. After obtaining an appropriate image, press the **[Calc]** key on the control panel.
2. Select the desired measurement item and then select the [PSV/EDV RI+SD] key. The horizontal line for the PSV measurement appears.
3. Perform the PSV measurement by moving the trackball and press the right or left trackball key [Set]. The horizontal line for the EDV measurement appears.
4. Perform the EDV measurement using the trackball and press the right/left trackball key [Set] again.

Note *The measurement results of PSV, EDV, RI and S/D are displayed and stored in the report.*

13.3.5.5 Time

To measure the Time in Spectral Doppler Mode:

1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. To measure a horizontal time interval, touch the [Time] key. A line appears in the screen.
4. Move the line to the start point of the measurement and press the right or left trackball key [Set].

Note *To re-adjust the start point, press the upper trackball key. A second line (parallel to the first one) appears.*

5. Move this line using the trackball to the end point of the measurement and then press [Set].

13.3.5.6 HR (Heart Rate)

To measure the Heart Rate (HR) in Spectral Doppler Mode:

1. Press the **[Calc]** key on the control panel.
2. Select the desired item. For example: select [Left Renal Artery].
3. Select the [HR] item in the menu area. A line appears on the screen.
4. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.
5. Select the number of heart rate cycles for the measurement with the corresponding digipot.
6. Move the second line to the end point of the period (according to the selected number of heart rate cycles to be measured).

7. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

13.3.6 Abdomen - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of abdomen calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.4 Small Parts Calculations

Application “Small Parts”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Small Parts Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.4.1 Items of Small Parts Calculations

13.4.1.1 Small Parts - Default

The items of small parts / default calculations in each mode are as follows:

2D/3D Mode	Left/Right Thyroid, Left/Right Testicle
M Mode:	Vessel
Doppler Mode:	Vessel

13.4.1.2 Small Parts - Breast

The items of small parts / breast calculations in 2D mode are as follows:

Lesion #1 -5	Nipple-Les. Dist.
	Skin-Les. Dist.
	Length
	Width
	Height

13.4.2 Before starting Small Parts Calculations



1. Press the **[Patient]** key on the control panel, select the [SM P] page and enter all patient information for Small Parts calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Small Parts. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.4.3 Small Parts Calculations in 2D Mode

- Distance Measurements (like Length, Height, etc.)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

The measurement procedures in 2D Mode are the same than in application “Abdomen”. review: Abdomen Calculations in 2D Mode 'Abdomen Calculations in 2D Mode' *on page 13-13*.

13.4.4 Small Parts Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time
- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application “Abdomen”. review: Abdomen Calculations in M Mode 'Abdomen Calculations in M Mode' *on page 13-14*.

13.4.5 Small Parts Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD
- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application “Abdomen”. review: Abdomen Calculations in Spectral Doppler Mode 'Abdomen Calculations in Spectral-Doppler Mode' *on page 13-16*.

13.4.6 Small Parts - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of small parts calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.5 Obstetric Calculations

Application “Obstetric”, (Factory - Sub Category: **Biometry**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements (e.g., Gestational Age & Growth, Fetal Weight, etc.) in the Obstetric Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.5.1 Items of Obstetric Calculations

The items of obstetric calculations in each mode are as follows:

Sub-application	Study	Measurement items	2D	D	M
Biometry	Fetal Biometry	BPD, HC, AC, FL, HL, OFD; APAD, TAD, CEREB, NF	X		
	Early Gestation	CRL, GS, YS, BPD, FL, NT	X		
	Long Bones	HL, RAD, ULNA, TIB, FIB, CLAV	X		
	Fetal Cranium	CEREB, CM, BOD, IOD, NT, Va, Vp, HEM, C.S.P, NF	X		
	AFI	Q1, Q2, Q3, Q4	X		
	Uterus	Length, Height, Width, Endo. Thickn., Cervix Lengt	X		
	Lt/Rt Ovary	Length, Height, Width	X		
	Umbilical Vein	Diam	X		
	Lt / Rt Uterine	Uterine A. Diam	X		
	Ductus Art., Ao, Carotid, MCA, Umbilical Art., Uterine Art.	Auto Trace; PS; RI; PS, ED RI, SD; Manual Trace; ED; PI; HR		X	
	Umbilical Vein	MeanV		X	
	Ductus Ven.	S; D; a; Manual Trace; S,a PLI; PI; PVIV; HR		X	
	Uterine Art.	Auto Trace; PS			
	FHR	FHR		X	X
Z-Scores	Long Axis	AV, Asc Aorta	X		
	Aortic Arch	AV, Asc Aorta, Desc Aorta, Inf. Vena Cava	X		
	Short Axis	PV, Main PA, Right PA, Left PA	X		
	Obl. Short Axis	Art. Duct	X		
	4 Chamber	TV, RV EDD, RV Inlet, RV Area, MV, LV EDD, LV Inlet, LV Area	X		
Fetal Echo	4-Chamber-View	Ventr. L, Ventr. W, Atrial-L, Atrial-W, Ventr.inl., Ventr. area, Wall thick., Septum, TV orifice, MV orifice	X		
	Thorax	Heart diagonally, Thorax diag., Cardiac circ., Thoracic, Heart area, Thorax area, Cardiac axis	X		
	Outflow Tract	Pulm. art., PV width, Main PA, AV width, Ao.root diam, Ao.trunk diam., Art.duct diam	X		
	Aortic arch	Anulus, Asc.aorta diam, Desc.aorta diam	X		
	Venous	SVC, IVC	X		
	4-Chamber-view	Vent. dim., Vent. wall, Atr. dim., Septum, Bivent. inner, Bivent. outer, MV open exc., TV open exc.			X
	Outflow Tract	AV diam., PV diam.			X

13.5.2 Before starting Obstetric Calculations



1. Press the **[Patient]** key on the control panel, select the [OB] page and enter all patient information for Obstetric calculations (e.g., LMP and Fetus #). For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End/New] or [End/Exit].*

Each OB exam supports multiple gestation studies with separate worksheet information for each fetus.

For multiple gestation examinations the corresponding “Fetus #” (max. 4 fetuses) must be entered in this page before measurements are performed.

If a Fetus number has been entered, several fetuses can be measured on one patient.



Touch this Menu control to change from the 1st (A) fetus to the 2nd (B) or 3rd (C) or 4th (D) fetus.



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Obstetric. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.5.3 Obstetric Calculations in 2D Mode

- Distance Measurements 'Distance Measurements' *on page 13-25* (like BPD, FL, etc.)
- Circumference Measurements 'Circumference Measurements' *on page 13-26* (like HC, AC, etc.)
- AFI Calculation 'AFI Calculation' *on page 13-26*

13.5.3.1 Distance Measurements



1. Press the **[Calc]** key on the control panel.
2. Select the study for the corresponding item. For example: select [Fetal Biometry].
3. Select the desired measurement parameter. For example: select [BPD].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

13.5.3.2 To calculate GS (Gestational Sac)

NOTE:

For the GS *(Gestational Sac)* calculation 2 methods are possible:

1. measurement of 3 Distances (mean value = GS diameter)

2. measurement of 1 Distance (value = GS diameter)

To select the desired calculation method; review: Measure Setup - To Edit a Sub Category, Study or Measure Item 'Measure & Calc' *on page 17-4*

Method 1:

“Triple Caliper” requires 3 measurements (D1, D2, D3 (length, width, height)) before it shows age. The age is derived from the mean value of all three measurements.

1. Select [Early Gestation] and then [GS]. A cursor appears.
2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

4. Measure the second distance as described above.
5. Perform the measurement of the third distance in the same manner.

Method 2:

The result is displayed immediately after the measurement of the 1 Distance.

1. Select [Early Gestation] and then [GS]. A cursor appears.
2. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
3. Move the second cursor to the second point of the measurement and press [Set] again. The distance between the two points is displayed.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

13.5.3.3 Circumference Measurements



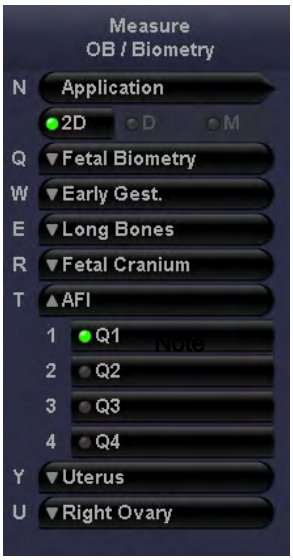
1. Press the **[Calc]** key on the control panel.
2. Select the study for the corresponding item. For example: select [Fetal Biometry].
3. Select the desired measurement parameter. For example: select [HC].
4. Using the trackball, position the cursor on the perimeter of the shape to be measured. Press the right or left trackball key [Set] to fix the mark. A second cursor appears.
5. Move the second cursor (to form an appropriate ellipse) and press [Set] again.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

6. Adjust the width of the ellipse by means of the trackball and then press the right trackball key [Set].

13.5.3.4 AFI Calculation

To calculate AFI, the Amniotic Fluid Index (distances are measured in several images):



1. Press the **[Calc]** key on the control panel.
2. Select the [AFI] item and then select [Q1].
3. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
4. Move the second cursor to the second point of the measurement and press [Set] again. The distance between the two points is displayed.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

5. Press **[Freeze]** to return to the scan mode, record the next image and then press **[Freeze]** again.
6. Press the **[Calc]** key on the control panel, select the [Q2] item and then perform the measurement using the trackball and the right trackball key.
7. Perform the distance measurement of [Q3] and [Q4] in the same manner.

13.5.3.5 Early Gest. - NT

To calculate NT, the Nuchal Translucency:

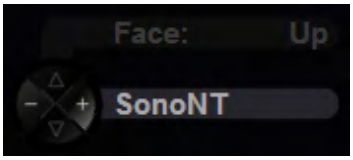
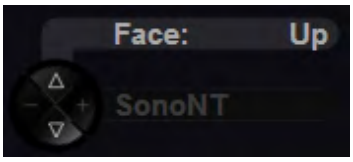
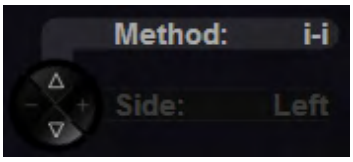
- Manual NT: Same as standard distance measurement: 'Distance Measurements' *on page 13-25*
- SonoNT: Follow these instructions to carry out a semi-automated NT measurement.

SonoNT is not available in all countries.

1. Choose the study ***Early Gestation*** from the subcategory ***Biometry*** in the ***OB*** application.
2. Click the ***NT*** measure item.
3. If it isn't enabled by default, switch to ***SonoNT*** by using the **Menu Soft Buttons**.
4. Use the trackball to draw a box around the nuchal fold. Press the right or left trackball key to set the first corner point of the box. A second cursor appears.
5. Move the second cursor to the second corner point of the box and press the right or left trackball key again.

Note *To re-adjust the corner points, press the upper trackball key. This alternates the control from one cursor to the other.*

6. If the analysis finds a result: The NT measurement will be displayed. The NT position can now be changed, using the ***Face up / Face down*** buttons. If the analysis can not find a result, a warning appears on screen: *No valid NT-distance found!* Start over with step 4.
7. Press the right or left trackball key to accept and store the NT measurement.

	NT Method	Use the +/- menu soft buttons to switch between “Manual” or “Sono” NT.
	Face up/down	Use the up/down menu soft buttons to switch between “Face up” or “Face down”. Select according to scanned image.
	i-i, i-m	Use the up/down menu soft buttons to change the NT calculation algorithm. i-i: inner - inner* i-m: inner - middle**
*K Nicolaides. The 11-13+6 weeks scan. Fetal Medicine Foundation, London 2004 ** FMF Certificate of Competence in the measurement of Nuchal translucency, http://www.fetalmedicine.com/fmf/training-certification/certificates-of-competence/11-13-week-scan/nuchal/, 2010		

The NT measurement will be displayed in the worksheet as follows:



1. Manual NT
2. “1” - inner - inner
3. “2” - inner - middle

13.5.4 Display of 2D Measurement Results



BPD: GA: EDD:

Type of Measurement Gestational Age Estimated Date of Delivery

Note *EDD (Estimated Day of Delivery) is only displayed, if the selection of the field “Show EDD calc. on screen” in the Measure Setup is “**Yes**”. For further details, review: Global Parameters* 'Global Parameters' *on page 17-19*

There are 3 possibilities to display 2D Measurement results:

1.



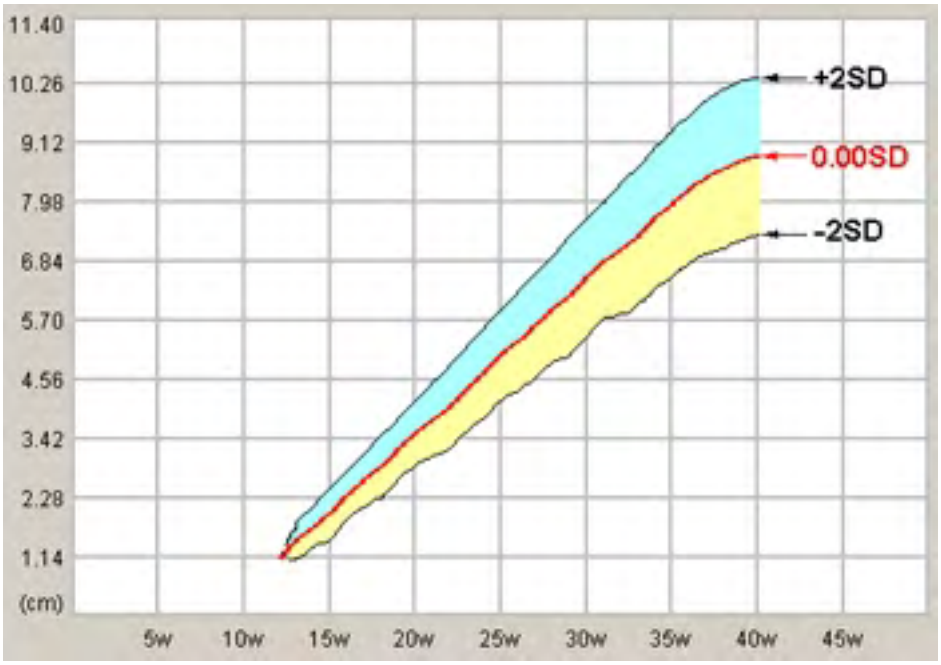
no clinical GA available **no growth percentile (%) or standard deviation (SD) display**

2.



Display of the Standard Deviation (e.g., 0.6SD)

e.g.	Mean: Min./Max.: out of range:	0.00 SD -2SD / +2SD < SD / > SD



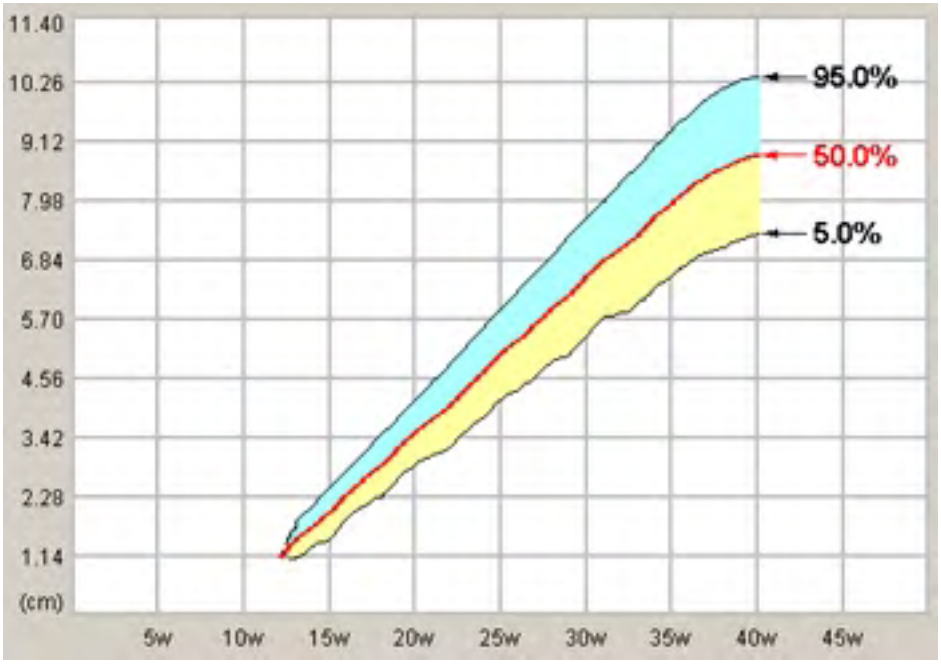
Note *Selection of the field "Growth Dev. Display" in the Measure Setup is "**SD**". For further details, review: Global Parameters* 'Global Parameters' *on page 17-19*

3.



Display of the growth percentile (e.g., 71.9%)

e.g.	Mean: Min./Max.: out of range:	50% 5.0% / 95.0% <5.0% / >95.0%



Note *Selection of the field "Growth Dev. Display" in the Measure Setup is "%". For further details, review: Global Parameters* 'Global Parameters' *on page 17-19*

13.5.5 Obstetric Calculations in M Mode

- FHR (Heart Rate)

The measurement procedure is the same than the measurement in Doppler Mode. review: Obstetric Calculations in Spectral Doppler Mode 'Obstetric Calculations in Spectral-Doppler Mode' *on page 13-30* .

13.5.6 Obstetric Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD
- HR (Heart Rate)

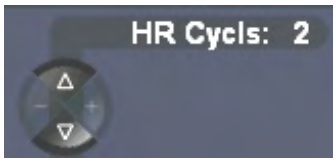
The measurement procedures in Spectral Doppler Mode are the same than in application "Abdomen". review: Abdomen Calculations in Spectral Doppler Mode 'Abdomen Calculations in Spectral-Doppler Mode' *on page 13-16* .

- FHR (Fetal Heart Rate) 'FHR (Fetal Heart Rate)' *on page 13-30*

13.5.6.1 FHR (Fetal Heart Rate)

1. To measure the Fetal Heart Rate in Spectral Doppler Mode (or M Mode), press the **[Calc]** key on the control panel.

2. Select the [FHR] item and the measure parameter [FHR]. A vertical line appears on the screen.
3. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.
4. Move the second line to the end point of the period.



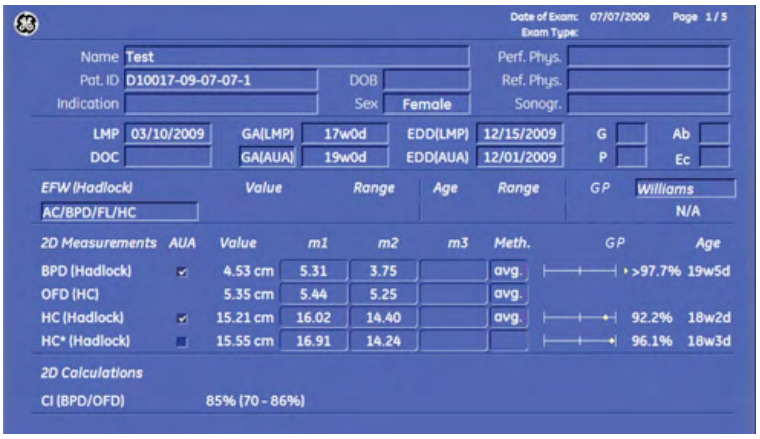
5. Select the number of heart rate cycles for measurement using this digipot.
6. If necessary, adjust the [Angle] and the [Baseline].
7. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

13.6 Obstetric - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of obstetric calculations.

The worksheet appears as follows (e.g., summary report “Calc”).





With this Menu control, additional worksheet pages of the measured Fetus (e.g., Fetus **A**) can be selected.



Touch this Menu control to change from the 1st (A) fetus to the 2nd (B) or 3rd (C) or 4th (D) fetus.

Growth-Percentile (GP)-bars:

	Growth value position within the confidence interval
	Growth value just too small for the confidence interval
	Growth value too small for the confidence interval
	Growth value just too big for the confidence interval
	Growth value too big for the confidence interval

Note *These bars are only displayed when the **Growth Dev. Display** is set to "%".* 'Global Parameters' *on page 17-19*

To close the worksheet, press the **[Exit]** key.



The appearance of the Obstetric worksheet depends on:

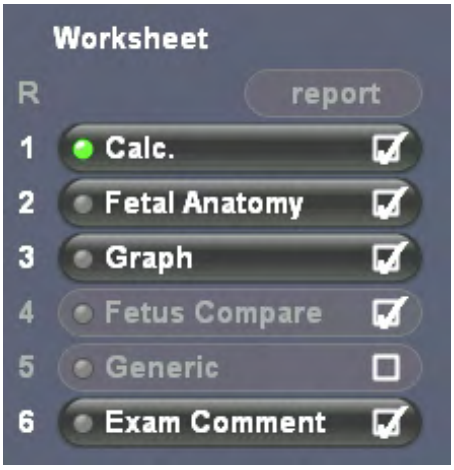
- information that was entered in the Obstetric Patient Information page
- adjustments in the Measure Setup Pages

  For more information see 'The Measure Setup Pages' *on page 17-3.*
- the performed measurements
- the selected "summary report" pages

Note *It is now possible to switch between Gyn and OB worksheets (if both worksheets exists).*

For more information see 'Measure & Calc' *on page 17-4.*

For additional functions please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.



Use following items to switch between different summary reports.

13.6.1 Summary Report - Calc



This is the “default” page that is displayed after activating the worksheet function.

The “Summary Report - Calc” is always included in the report printout. For further details review: To print a Report 'To print a Report' *on page 13-9* 'To print a Report' *on page 13-9*.

13.6.2 Summary Report - Fetal Anatomy



The first page of an Anatomy checklist of the Fetus (e.g., Fetus **A**) is displayed.

You can set every item’s status in the check list to Abnormal, Normal, Seen or Not Seen.

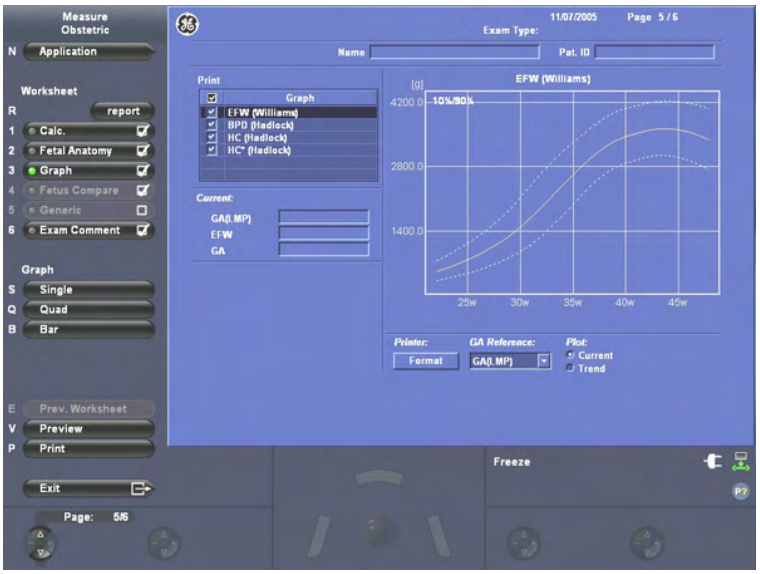


Normal	Click this button to set all values in the checklist to “Normal”.
Seen	When all values are set to “Normal”, click this button to set all values in the checklist to “Seen”.
Clear	Click this button to clear all values in the checklist.

13.6.3 Summary Report - Graph



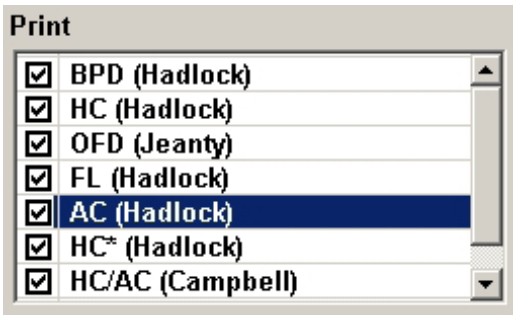
By selecting this item any stored measurement can be viewed in a Graph display. (e.g., **Single** Display)



To view the stored measurement graphs, select the desired item using the trackball and trackball keys.



In multiple gestations, the growth of each fetus is indicated with a different mark.



The “check marks” indicate the stored measurement graphs. Use the trackball and the trackball keys to select/deselect the parameters.

Note *Before printing the report, check your selection; review: To print a Report* 'To print a Report' *on page 13-9.*

Current: Shows the gestational age, etc. of the currently selected fetus

History: Using the arrow buttons (x25C4x25BA) the history of each fetus can be viewed.

Printer: Click on the [Format] button to change the Print Format of the Graphs.

GA Reference: Select either: GA(LMP) or GA(AUA)

Plot: Select either: Current or Trend.

review: Patient Information – Obstetric (OB) '“Patient Information” screen' *on page 4-9*

Fetus: For multiple gestations only.

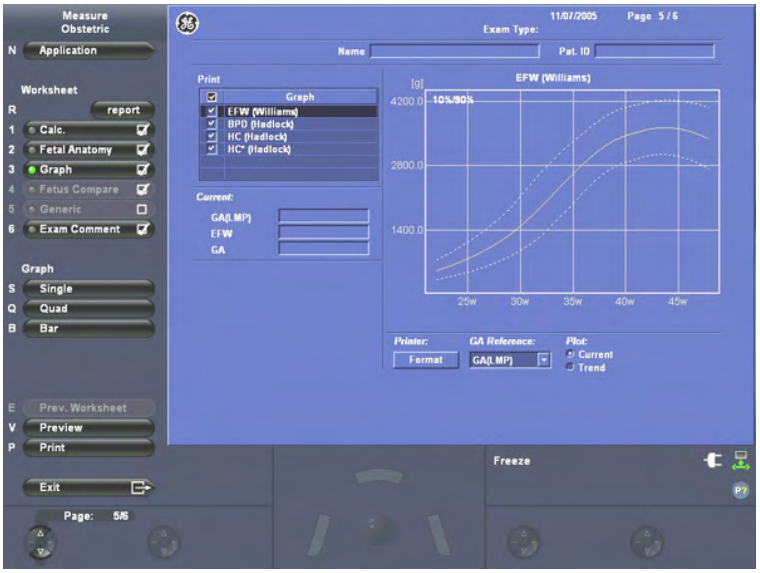
To change the graph display select the [Single], [Quad] [Bar] item in the menu area.

Bar - Display

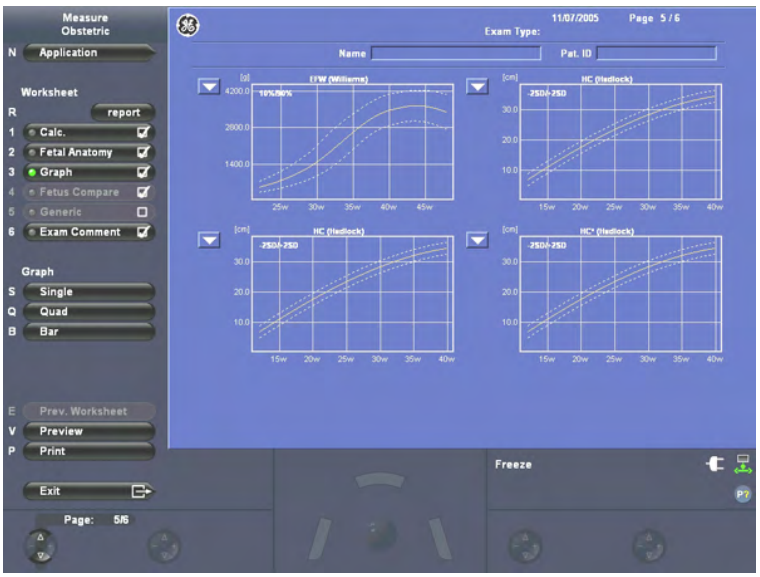


Note *The Bar graph display can also be included on the report.*

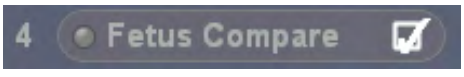
Single - Display



Quad - Display



13.6.4 Summary Report - Fetus Compare



Select this item to compare all measurement results of the measured fetuses.



13.6.5 Summary Report - Generic



This “Summary report” is only active if generic measurements were performed. For details review: Generic Measurements *Chapter 12*.

13.6.6 Summary Report - Exam Comment



Select this item to enter a comment using the keyboard, or to enter a previous defined comment by selecting the [Comment A], [Comment B] or [Comment C] item. For further details review: Exam Comment 'Exam Comment' *on page 13-7*.

The “Summary Report - Exam Comment” is always included in the report printout. For further details review: To print a Report 'To print a Report' *on page 13-9*.

13.7 Cardiac Calculations

Application “Cardiology”, (Factory - Sub Category: **Biometry**) allows measurements/ calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Cardiology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.7.1 Before starting Cardiology Calculations



1. Press the **[Patient]** key on the control panel, select the [CARD] page and enter all patient information for Cardio calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Cardiology. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.7.2 Cardiology Calculations in 2D Mode

- LV Simpson 'LV Simpson' *on page 13-38*
- Vol A/L (Volume Area/Length) 'Vol A/L (Volume Area/Length)' *on page 13-39*
- LV (Left Ventricle) 'LV (Left Ventricle)' *on page 13-39*
- LV Mass 'LV Mass' *on page 13-40*
- LVOT- or RVOT Diameter 'LVOT- or RVOT Diameter' *on page 13-41*
- MV (Mitral Valve) 'MV (Mitral Valve)' *on page 13-41*
- TV (Tricuspid Valve) 'TV (Tricuspid Valve)' *on page 13-42*
- AV/LA (Aortic Valve/Left Atrium) 'AV/LA (Aortic Valve/Left Atrium)' *on page 13-42*
- PV (Pulmonary Valve) 'PV (Pulmonary Valve)' *on page 13-42*

13.7.2.1 LV Simpson

To calculate the left ventricular (end diastolic or end systolic) volume in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [LV Simps.].
3. Select the desired measurement parameter. For example: select [4CH Dias.].
4. Perform the circumference measurement of the left ventricle by using the trackball key and then press the right or left trackball key [Set].
5. Move the trackball to the longitudinal axis of the left ventricle and [Set] the endpoint.

13.7.2.2 Vol A/L (Volume Area/Length)

To calculate Volume A/L in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [Vol A/L].
3. Select the desired measurement parameter. For example: select [LV Vol. Dias.].
4. Perform the circumference measurement of the left ventricle by using the trackball key and then press the right or left trackball key [Set].
5. Move the trackball to the longitudinal axis of the left ventricle and [Set] the endpoint.

13.7.2.3 LV (Left Ventricle)

To calculate the distances IVSd, IVSs, LVDd, LVDs, LVPWd, LVPWs and RVDd in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [LV].
3. Select the desired measurement parameter. For example: select [IVSd].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

6. Measure the next distance in the same manner (and so on).

Note

Finish either all of the diastolic or the systolic measurements first. Pressing the upper trackball key allows for accessing the cine memory. Scroll to either the appropriate systolic or diastolic image.

13.7.2.4 LV Mass

This is used for the measurement of the Left Ventricular volume and mass. It is correctly measured only during the diastolic phase (LV expanded).



1. Press the **[Calc]** key on the control panel.
2. Select the item [LV Mass].
3. Select the desired measurement parameter. For example: select [Epi Area].

   Perform the measurement of the Epicardial Area, Endocardial Area and Epicardial Length prior to the LV mass measurement.
4. When the cursor appears in the image, measure the selected item using the trackball and the right or left trackball key [Set].
5. To obtain the second, orthogonal image, press **[Freeze]**. Scan the image and press **[Freeze]** again.

When using Dual 2D mode, it is not necessary to unfreeze during measurements.

13.7.2.5 LVOT- or RVOT Diameter

Note *This 2D measurement is part of the LVOT / RVOT Doppler measurements.*

To calculate the LVOT- or RVOT diameter in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [LVOT] or [RVOT].
3. Select the corresponding measurement parameter. For example: select [LVOT Diam].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

   To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

13.7.2.6 MV (Mitral Valve)

To measure Distance A, Distance B or Area of the MV *(Mitral Valve)* in 2D mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [MV].
3. Select the appropriate measurement parameter. For example: select [Dist A].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

13.7.2.7 TV (Tricuspid Valve)

To measure the Diameter of the TV *(Tricuspid Valve)* in 2D mode:

1. Press the **[Calc]** key on the control panel.
2. Select the item [TV] and then the measurement parameter [TV Diam].
3. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
4. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

13.7.2.8 AV/LA (Aortic Valve/Left Atrium)

To measure the Aortic Diameter or the Left Atrium Diameter in 2D mode:

1. Press the **[Calc]** key on the control panel.
2. Select the item [AV/LA] and then the desired measurement parameter [Ao Diam] or [LA Diam].
3. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
4. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

13.7.2.9 PV (Pulmonary Valve)

To measure the Diameter of the PV *(Pulmonary Valve)* in 2D mode:

1. Press the **[Calc]** key on the control panel.
2. Select the item [PV] and then the measurement parameter [PV Diam].
3. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
4. Move the second cursor to the second point of the measurement and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

13.7.3 Cardiology Calculations in CFM Mode

PISA *For more information see* 'PISA' *on page 13-42.*

13.7.3.1 PISA

To measure the PISA Radius of the Mitral Valve (MV), Tricuspid Valve (TV), Aortic Valve (AV) and Pulmonary Valve (PV) in Color Flow Mode:



1. After obtaining a feasible Color Doppler image, press the **[Calc]** key on the control panel.
2. Select the appropriate item. For example: select [MV].
3. Select the measurement parameter [PISA]. The cursor appears on the screen.
4. Perform the distance measurement using the trackball and press the right or left trackball key [Set].
5. Move the second cursor to the second point of the measurement and press [Set] again.

13.7.4 Cardiology Calculations in M Mode

- LV (Left Ventricle) 'LV (Left Ventricle)' *on page 13-43*
- AV/LA (Aortic Valve/Left Atrium) 'AV/LA (Aortic Valve/Left Atrium)' *on page 13-44*
- MV (Mitral Valve) 'MV (Mitral Valve)' *on page 13-45*
- HR (Heart Rate) 'HR (Heart Rate)' *on page 13-46*

13.7.4.1 LV (Left Ventricle)

There are two methods to calculate the Left Ventricle in the M mode:

- To measure all Items at a Time 'To measure all Items at a Time' *on page 13-43*
- To measure the Item One by One 'To measure the Items One by One' *on page 13-44*

13.7.4.1.1 To measure all Items at a Time

To calculate all the items of the Left Ventricle in M mode at a time:



1. Press the **[Calc]** key on the control panel.
2. Select the item [LV] and then touch [LV Study]. A vertical line with a cursor appears in the M Mode trace display.

   The measurement parameter that has to be performed next is shown on the lower right corner of the screen (e.g., IVSd).
3. Use the trackball to move the cursor on the line to the position of the anterior septum signal of the Diastole and press the right or left trackball key [Set] to fix it.
4. Move the second cursor to the anterior IVSd signal and press the right or left trackball key [Set]. The mark is fixed and the next cursor will appear.
5. Move the cursor to LVDd and press [Set]. The mark is fixed and the next cursor appears.
6. Move the cursor to LVPWd and press the right or left trackball key [Set] again. The mark is fixed and a new vertical line with a cursor appears.
7. Use the trackball to move the cursor on the line to the anterior systolic position of the IVSs signal and press the right or left trackball key [Set] to fix it.
8. Move the second cursor to the anterior IVSs signal and press the right or left trackball key [Set]. The mark is fixed and the next cursor will appear.
9. Move the cursor to LVDs and press [Set]. The mark is fixed and the next cursor appears.
10. Move the cursor to LVPWs and press the right or left trackball key [Set] again. The mark is fixed and the measurement of the Left Ventricle is completed.

Note *Additionally also [RVDd] and [HR] can be measured. If the Heart Rate is measured, also the Cardiac Output is calculated and shown in the worksheet.*

IVSd: Interventricular Septum - diastolic LVDd: Left Ventricle Diameter - diastolic LVPWd: Left Ventricular Posterior Wall - diastolic IVSs: Interventricular Septum - systolic LVDs: Left Ventricle Diameter - systolic LVPWs: Left Ventricular Posterior Wall - systolic

13.7.4.1.2 To measure the Items One by One

To calculate the items such as IVSd, LVDd, LVPWd, IVSs, LVDs, LVPWs and RVDd in M mode:

1. Press the **[Calc]** key on the control panel.
2. Select [LV] and then select the desired measurement item.
3. Perform the measurement using trackball and the right or left trackball key [Set].

13.7.4.2 AV/LA (Aortic Valve/Left Atrium)

To measure the Aortic Root Diameter, the Left Atrial Diameter, the Aortic Cusp Separation and the Aortic Root Amplitude in M mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [AV/LA]
3. Select the desired measurement parameter. For example: select [Ao Root Diam].
4. Use the trackball to move the cursor to the start point of the measurement and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the measurement and press [Set] again.

   To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.

Aortic Root Diameter: distance between the anterior aortic wall and the posterior aortic wall
Left Atrial Diameter: distance between posterior aortic wall echo and posterior left atrial wall
Aortic Cusp Separation: distance between the coronary cusp and the non coronary cusp

13.7.4.3 MV (Mitral Valve)

There are two methods to calculate the Mitral Valve in the M mode:

- To measure all Items at a Time 'To measure all Items at a Time' *on page 13-45*
- To measure the Items One by One 'To measure the Items One by One' *on page 13-46*

13.7.4.3.1 To measure all Items at a Time

To calculate all the items of the Mitral Valve in M mode at a time:



1. Press the **[Calc]** key on the control panel.
2. Select the item [MV] and then select [All].
3. The $+^{D}$ cursor appears on the M mode image. Move the cursor to the D point and press the right or left trackball key to fix the mark.
4. The $+^{E}$ cursor appears on the screen. Move the cursor to the E point and press the right or left trackball key to fix the mark.
5. The $+^{F}$ cursor appears on the screen. Move the cursor to the F point and press the right or left trackball key to fix the mark.
6. The $+^{A}$ cursor appears on the screen. Move the cursor to the A point and press the right or left trackball key to fix the mark.
7. The $+^{C}$ cursor appears on the screen. Move the cursor to the C point and press the right or left trackball key to fix the mark.
8. The $+^{EPSS}$ cursor appears on the screen. Move the cursor to the EPSS point and press the right or left trackball key to fix the mark.

D: End of systolic, immediately before the opening of Mitral Valve.

E: The anterial leaflet of the mitral valve opens, it peaks at E.

F: Lowest point of the initial diastolic closing.

A: In atrial systole, blood is propelled through the mitral orifice and the mitral leaflets reopen. The peak of this phase of mitral valve motion is indicated as A.

C: Complete closure occurs after the onset of ventricular systole.

EPSS: Distance between the Mitral Valve E point and the posterior edge of the interventricular septum at the same point in time.

13.7.4.3.2 To measure the Items One by One

To measure the items such as D-E, EPSS, E-F Slope, A-C Interval:

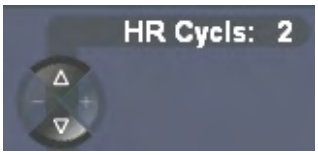
1. Press the **[Calc]** key on the control panel.
2. Select [MV] and then select the appropriate item.
3. Perform the measurements by using the trackball and the right or left trackball key.

13.7.4.4 HR (Heart Rate)

To measure the Heart Rate in M Mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item Heart Rate [HR]. A vertical line appears on the screen.
3. Move the line to the start point of the period and press the right or left trackball key [Set]. The second line appears.



4. Select the number of heart rate cycles necessary for measurement using this digipot.
5. Move the second line to the end point of the period (according to the selected number of heart rate cycles to be measured).
6. Press the right or the left trackball [Set] key again. The Heart Rate is displayed.

13.7.5 Cardiology Calculations in Spectral-Doppler Mode

- MV (Mitral Valve) 'MV (Mitral Valve)' *on page 13-47*
- AV (Aortic Valve) 'AV (Aortic Valve)' *on page 13-48*
- TV (Tricuspid Valve) 'TV (Tricuspid Valve)' *on page 13-49*
- PV (Pulmonary Valve) 'PV (Pulmonary Valve)' *on page 13-49*
- LVOT- or RVOT Doppler 'LVOT- or RVOT Doppler' *on page 13-49*

- Pulmonic Veins 'Pulmonic Veins' *on page 13-50*
- PAP (Pulmonary Artery Pressure Measurement) 'PAP (Pulmonary Artery Pressure Measurement)' *on page 13-50*
- HR (Heart Rate) 'HR (Heart Rate)' *on page 13-50*

13.7.5.1 MV (Mitral Valve)

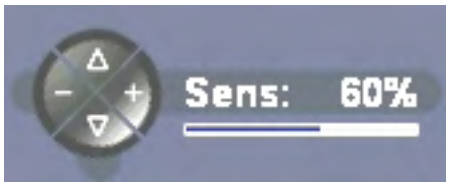
There are different methods to perform measurements and calculations of the Mitral Valve in the Spectral-Doppler mode:

- Auto Trace 'Auto Trace' *on page 13-47*
- Manual Trace 'Manual Trace' *on page 13-48*
- To measure the Items One by One 'To measure the Items One by One' *on page 13-48*

13.7.5.1.1 Auto Trace



1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.
2. Select the measurement item [MV] and then select [Auto Trace]. The Doppler spectrum is traced automatically and the results are displayed.



3. Select the sensitivity of the envelope curve (to eliminate artifacts).



4. Select the Trace Mode channel of the envelope curve
5. If necessary, adjust the [Angle] and the [Baseline].



A green line appears at the left of the spectrum. Press the upper trackball key [Change] to move the line and readjust the start cycle (the line changes to yellow). Press the right or left trackball key [Set] to fix the line. A green line appears at the right of the spectrum. Press the [Change] key again (line changes to yellow), move the line to readjust the end cycle and fixate it with [Set].

The status area shows the current function of the trackball.



Press the right or left trackball key [Set] to finish the measurement.

Remark:

To select the Doppler measuring results, which should be displayed after an Auto Trace measurement, review: Application Parameters 'Application Parameters' *on page 17-17 .*

13.7.5.1.2 Manual Trace

1. After obtaining a feasible Doppler spectrum, press the **[Calc]** key on the control panel.
2. Select the measurement item [MV] and then select [Manual Trace]. A cursor appears on the Doppler spectrum.
3. Move the cursor to the start point of the period and press the right or left trackball key [Set] to fix the marker. Begin trace.

Note *To re-adjust the traced line, press the upper trackball key [Undo] repeatedly.*

4. Trace to the end of the period and press the [Set] key again to fix the mark.

Remark:

To select the Doppler measuring results, which should be displayed after the measurement (= “Auto/Manual Trace”) and to select if the envelope curve will be performed with a continuous trace line or by setting points (= “Manual Trace Mode”), review: Application Parameters 'Application Parameters' *on page 17-17 .*

13.7.5.1.3 To measure the Items One by One

To measure the Item such as Peak E + A, Dec Time, PHT, IVRT:

1. Press the **[Calc]** key on the control panel.
2. Select [MV] and then select the appropriate item.
3. Perform the measurements by using the trackball and the right or left trackball key [Set].

13.7.5.2 AV (Aortic Valve)



There are different methods to perform measurements and calculations of the Aortic Valve in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve. *For more information see* 'MV (Mitral Valve)' *on page 13-47.*

13.7.5.3 TV (Tricuspid Valve)



There are different methods to perform measurements and calculations of the Tricuspid Valve in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve. *For more information see* 'MV (Mitral Valve)' *on page 13-47.*

13.7.5.4 PV (Pulmonary Valve)



There are different methods to perform measurements and calculations of the Pulmonary Valve in the Spectral-Doppler mode. The measurement methods are similar to those of the Mitral Valve. *For more information see* 'MV (Mitral Valve)' *on page 13-47.*

13.7.5.5 LVOT- or RVOT Doppler



There are different methods to perform measurements of LVOT (Left Ventricle Outflow Tract) or RVOT (Right Ventricle Outflow Tract) in the Spectral-Doppler mode. The measurement

methods are similar to those of the Mitral Valve. *For more information see* 'MV (Mitral Valve)' *on page 13-47.*

13.7.5.6 Pulmonic Veins

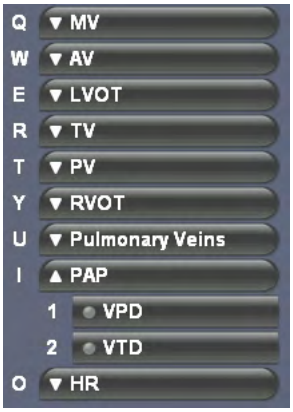
To measure the Items such as Diastolic Velocity, Systolic Velocity, A. Reverse Velocity, or A. Reverse Duration in Spectral-Doppler mode:



1. Press the **[Calc]** key on the control panel.
2. Select the appropriate item. For example: select [Dias. V].
3. If necessary, select the [Angle] and the [Baseline].
4. Perform the measurement by using the trackball and the right or left trackball key [Set].

13.7.5.7 PAP (Pulmonary Artery Pressure Measurement)

To measure the items such as VPD (protodiastolic velocity) or VTD (telediastolic velocity) in Spectral-Doppler mode:



1. Press the **[Calc]** key on the control panel.
2. Select the item [PAP].
3. Select the appropriate measurement parameter. For example: select [VPD].
4. If necessary, select the [Angle] and the [Baseline].
5. Perform the measurement by using the trackball and the right or left trackball key [Set].

13.7.5.8 HR (Heart Rate)

The method of the measurement is the same as that of measuring the Heart Rate in M mode.

operation review: HR (Heart Rate) 'Cardiology Calculations in M Mode' *on page 13-43*

13.7.6 Cardiology - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of cardio calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.8 Urology Calculations

Application “Urology”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Urology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.8.1 Items of Urology Calculations

The items of urology calculations in each mode are as follows:

2D/3D Mode	Left/Right Kidney, Bladder, Prostate, Left/Right Testicle, Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel
M Mode:	Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel
Doppler Mode:	Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel

13.8.2 Before starting Urology Calculations



1. Press the **[Patient]** key on the control panel, select the [URO] page and enter all patient information for Urology calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



1. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Urology. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.8.3 Urology Calculations in 2D Mode

- Distance Measurements (like Length, Height, etc.)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

The measurement procedures in 2D Mode are the same than in application “Abdomen”. review: Abdomen Calculations in 2D Mode 'Abdomen Calculations in 2D Mode' *on page 13-13*.

13.8.4 Urology Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time
- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application “Abdomen”. review: Abdomen Calculations in M Mode 'Abdomen Calculations in M Mode' *on page 13-14*.

13.8.5 Urology Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD

- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application “Abdomen”. review: Abdomen Calculations in Spectral Doppler Mode 'Abdomen Calculations in Spectral-Doppler Mode' *on page 13-16*.

13.8.6 Urology - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of urology calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.9 Vascular Calculations

Application “Vascular”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Vascular Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.9.1 Items of Vascular Calculations

The items of vascular calculations in each mode are as follows:

2D/3D Mode	Left/Right CCA *(Common Carotid Artery)*, Left/Right ECA *(External Carotid Artery)*, Left/Right ICA *(Internal Carotid Artery)*, Left/Right Bulb, Left/Right Vertebral Artery, Left/Right Subclavian Artery, Vessel
M Mode:	Left/Right CCA, Left/Right ECA, Left/Right ICA, Left/ Right Bulb, Left/Right Vertebral Artery, Left/Right Subclavian Artery, Vessel
Doppler Mode:	Left/Right CCA, Left/Right ECA, Left/Right ICA, Left/ Right Bulb, Left/Right Vertebral Artery, Left/Right Subclavian Artery, Vessel

13.9.2 Before starting Vascular Calculations

1. Press the **[Patient]** key on the control panel, select the [VAS] page and enter all patient information for Vascular calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Vascular. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.9.3 Vascular Calculations in 2D Mode

- Distance Measurements (like “Intima” and “Flow Diameter”)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter

The measurement procedures in 2D Mode are the same than in application “Abdomen”. review: Abdomen Calculations in 2D Mode 'Abdomen Calculations in 2D Mode' *on page 13-13*.

13.9.4 Vascular Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time

- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application “Abdomen”. review: Abdomen Calculations in M Mode 'Abdomen Calculations in M Mode' *on page 13-14*.

13.9.5 Vascular Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD
- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application “Abdomen”. review: Abdomen Calculations in Spectral Doppler Mode 'Abdomen Calculations in Spectral-Doppler Mode' *on page 13-16*.

13.9.6 Vascular - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of vascular calculations.





With this Menu control, additional worksheet pages can be selected.

Vessel Summary Select the corresponding page in the report to access the Vessel Summary. This feature makes it possible to select custom Doppler values for calculating the ICA/CCA value.

Note *Please check the automatically selected values for their correctness.*

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.10 Gynecology Calculations

Application “Gynecology”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Gynecology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.10.1 Items of Gynecology Calculations

The items of gynecology calculations in each mode are as follows:

Study	Measure item	2D	D	M
Uterus	length, width, height, endo.thickn., cervix length	X		
Uterine	Uterine A. diam.	X		
	Auto Trace; PS; RI; PS,ED RI,SD; Time; Manual Trace; ED; PI; HR		X	
	Time, Vessel Diam., Stenosis Diam., HR			X
Ovary	length, width, height	X		
Follicle	1-10	X		
Fibroid	1-10	X		
Pelvic Floor	Detrusor wall thick., Urethral rotation., Uterine desc. max, Rect. amp. desc. max,Rectocele depth, Bladder neck rest, Bladder neck stress,Bladder desc. max, Levator hiat. stress, Residual urine.	X		
Early Gest.	CRL, GS, YS, BPD, FL, NT	X		

Study	Measure item	2D	D	M
Ovarian	Auto Trace; PS; RI; PS,ED RI,SD; Time; Manual Trace; ED; PI; HR		X	
	Time, Vessel Diam., Stenosis Diam., HR			X
Vessel	Auto Trace; PS; RI; PS,ED RI,SD; Time; Manual Trace; ED; PI; HR		X	
FHR	FHR		X	X

13.10.2 Before starting Gynecology Calculations

1. Press the **[Patient]** key on the control panel, select the [GYN] page and enter all patient information for Gynecology calculations (e.g., expected Ovulation). For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Gynecology. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.10.3 Gynecology Calculations in 2D Mode

- Distance Measurements (like Length, Endo. Thickness, etc.)

The measurement procedures in 2D Mode are the same than in application “Abdomen”. review: Abdomen Calculations in 2D Mode 'Abdomen Calculations in 2D Mode' *on page 13-13*.

13.10.4 Gynecology Calculations in M Mode

- Vessel Diameter
- Stenosis Diameter
- Time
- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application “Abdomen”. review: Abdomen Calculations in M Mode 'Abdomen Calculations in M Mode' *on page 13-14*.

13.10.5 Gynecology Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item

- Measurement of PSV/EDV RI+SD
- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application “Abdomen”. review: Abdomen Calculations in Spectral Doppler Mode 'Obstetric Calculations in Spectral-Doppler Mode' *on page 13-30* 'Abdomen Calculations in Spectral-Doppler Mode' *on page 13-16*.

- FHR (Fetal Heart Rate)

The measurement procedure of the Fetal Heart Rate in Spectral Doppler Mode is the same than in application “Obstetrics”. review: Obstetric Calculations in Spectral Doppler Mode 'Obstetric Calculations in Spectral-Doppler Mode' *on page 13-30*.

13.10.6 Gynecology - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of gynecology calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

Note *It is now possible to switch between Gyn and OB worksheets (if both worksheets exists).*

Note *Review: First Trimester OB in application GYN* 'Measure & Calc' *on page 17-4*

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.11 Pediatric Calculations

Application “Pediatrics”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Pediatrics Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.11.1 Items of Pediatric Calculations

The items of pediatric calculations in each mode are as follows:

2D/3D Mode	Hip Joint
M Mode:	not yet specified
Doppler Mode:	not yet specified

13.11.2 Before starting Pediatric Calculations

1. Press the **[Patient]** key on the control panel, select the [PED] page and enter all patient information for Pediatric calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Pediatrics. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.11.3 Pediatric Calculations in 2D Mode

- Hip Joint 'Hip Joint' *on page 13-59*

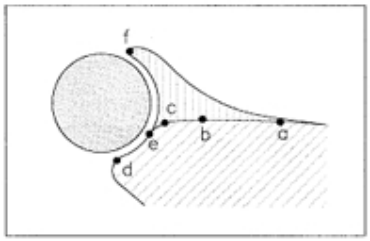
13.11.3.1 Hip Joint

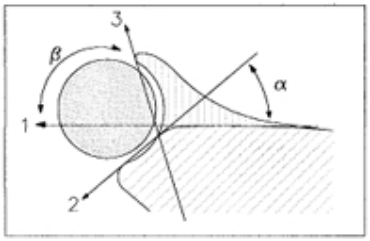
The [Hip Joint] calculation assists in assessing the development of the infant hip. In this calculation, three straight lines are superimposed on the image and aligned with the anatomical features. The two angles are computed, displayed, and can be used by the physician in making a diagnosis.



The order of entering the lines 1 to 3 **must** be followed.

Necessary measurements: Sketch: a-b (line 1) c-d (line 2) e-f (line 3)







1. Press the **[Calc]** key on the control panel.
2. Select the desired hip. For example: select [Left HIP].
3. Select the measurement parameter [Hip Joint]. A cursor appears on the screen.
4. Use the trackball to move the cursor to the start point of the **line 1** measurement (a-b) and press the right or left trackball key [Set] to fix the marker. A second cursor appears.
5. Move the second cursor to the second point of the **line 1** measurement (a-b) and press [Set] again.

Note *To re-adjust the start point, press the upper trackball key [Change] before completing the measurement. This alternates the control from one cursor to the other.*

6. Perform the measurement of the second distance (**line 2** , c-d) in the same manner.
7. Perform the measurement of the third distance (**line 3** , e-f) in the same manner.

After storing the 3rd line the evaluation appears on the screen.

alpha beta Type

The Type of the hip joint is evaluated according to the following table:

Type	alpha	beta
1a	> 60º	< 55º
2	43º - 60º	55º -77º
3/4	< 43º	> 77º

Note *The Hip Joint measurement must be calculated only with the included measurement software!*

13.11.4 Pediatric Calculations in M Mode

There are no specific measurements for application “Pediatrics” in M Mode.

13.11.5 Pediatric Calculations in Spectral-Doppler Mode

There are no specific measurements for application “Pediatrics” in Doppler Mode.

13.11.6 Pediatric - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of pediatric calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.12 Neurology Calculations

Application “Neurology”, (Factory - Sub Category: **Default**) allows measurements/calculations in 2D/3D mode, M mode and Spectral-Doppler mode, using various measure items. For details about settings, review: Measure Setup - Measure & Calc 'Measure & Calc' *on page 17-4*

The methods for obtaining measurements in the Neurology Calculations menu are similar to the generic measurement functions in 2D, M and Spectral Doppler mode.

13.12.1 Items of Neurology Calculations

The items of neurology calculations in each mode are as follows:

2D/3D Mode	Left/Right ACA *(Anterior Cerebral Artery)*, Left/Right MCA *(Middle Cerebral Artery)*, Left/Right PCA *(Posterior Cerebral Artery)*, Basilar Artery, A-Com A. *(Anterior Common Artery)*, P-Com A. *(Posterior Common Artery)*, Left/Right CCA *(Common Carotid Artery)*, Left/Right ICA *(Internal Carotid Artery)*, Left/Right Vertebral Artery, Vessel
M Mode:	Left/Right ACA, Left/Right MCA, Left/Right PCA, Basilar Artery, A-Com A., P-Com A., Left/Right CCA, Left/Right ICA, Left/Right Vertebral Artery, Vessel
Doppler Mode:	Left/Right ACA, Left/Right MCA, Left/Right PCA, Basilar Artery, A-Com A., P-Com A., Left/Right CCA, Left/Right ICA, Left/Right Vertebral Artery, Vessel

13.12.2 Before starting Neurology Calculations

1. Press the **[Patient]** key on the control panel, select the [NEURO] page and enter all patient information for Neurology calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*



2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to Neurology. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.12.3 Neurology Calculations in 2D Mode

- Distance Measurements (e.g., Flow Diameter)
- Vessel Area/Vessel Diameter
- Stenosis Area/Stenosis Diameter



The measurement procedures in 2D Mode are the same than in application “Abdomen”. review: Abdomen Calculations in 2D Mode 'Abdomen Calculations in 2D Mode' *on page 13-13*.

13.12.4 Neurology Calculations in M Mode

- Vessel Diameter

- Stenosis Diameter
- Time
- HR (Heart Rate)

The measurement procedures in M Mode are the same than in application “Abdomen”. review: Abdomen Calculations in M Mode 'Abdomen Calculations in M Mode' *on page 13-14*.

13.12.5 Neurology Calculations in Spectral-Doppler Mode

- Auto Trace
- Manual Trace
- Measurement of Each Item
- Measurement of PSV/EDV RI+SD
- Time
- HR (Heart Rate)

The measurement procedures in Spectral Doppler Mode are the same than in application “Abdomen”. review: Abdomen Calculations in Spectral Doppler Mode 'Abdomen Calculations in Spectral-Doppler Mode' *on page 13-16*.

13.12.6 Neurology - Worksheet



Press the **[Report]** key on the control panel to view the report that contains detailed results of pediatric calculations.





With this Menu control, additional worksheet pages can be selected.

To close the worksheet, press the **[Exit]** key.

For additional description please refer to Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*.

13.13 Musculoskeletal (MSK) Calculations

There are no measurements/calculations specified for application “MSK”.

13.13.1 Items of MSK Calculations

There are no items specified for application “MSK”.

13.13.2 Before starting MSK Calculations

1. Press the **[Patient]** key on the control panel, select the [MSK] page and enter all patient information for MSK calculations. For details refer to: Entering Patient Data 'Entering Patient Data' *on page 4-6*

Note *To cancel all calculations performed before and to start new measurement, press this key and select [End Exam] or [Clear Exam].*

2. Make sure that the probe and application are selected properly. If another application is selected, press the **[Probe]** key on the control panel, and change it to MSK. For details refer to: Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

13.13.3 MSK - Worksheet

For application “MSK”, there is no specific worksheet available.

Chapter 14

SonoView

Describes the archive system SonoView

SonoView

SonoView is an Image Management System that provides fast and extremely easy image management capabilities. SonoView allows users to store, view, report, and transfer images stored in the Voluson® i. In addition, SonoView allows users to send and receive DICOM images over the DICOM Network.



Press this key to shift from scan mode to SonoView mode.

SonoView is subdivided into three groups:

Selecting Exams 'Selecting Exams' *on page 14-2*

Image Review 'Image Review' *on page 14-9*

Tools 'Tools' *on page 14-14*

The images are stored according to the patient's ID. If an ID is not registered on the system, enter the ID for proper storing.



The results of calculations are recorded in "application-dependent" patient worksheets. By pressing on the **[Report]** key, the worklist page is switched on. For further details review: Basic Patient Worksheet Functions 'Basic Patient Worksheet Functions' *on page 13-5*

Please note: To Backup or Export exams to DVD/CD+(R)W disk, please confirm that the DVD/CD+(R)W storage medium used is clean and not scratched!


System Info
Warning: Disk space on drive D: is only 750 Mb.
Please export/backup or delete Sonoview images
or contact your local service department.
OK

When the hard disk (HDD) has reached its maximum capacity a warning message will be displayed on the screen.

To Backup the Exams 'To Backup the Exams' *on page 14-7*

Since DVD+(R)Wis a quite new type of media, data regarding the expected lifetime of a disc is rare. Therefore, it is recommended to copy data stored on a DVD every three years onto a new disc to avoid data loss.

14.1 Selecting Exams

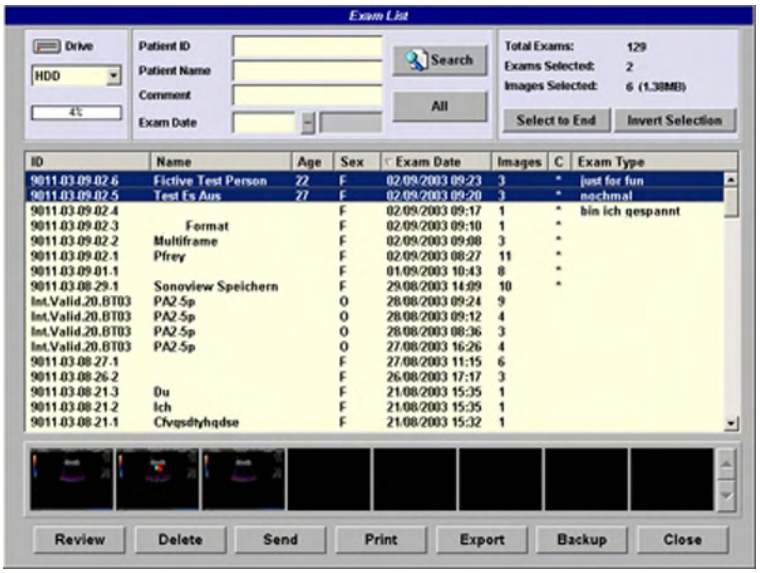
This chapter describes how to select, load, remove and back up exams. It also describes how to transfer exams to another system via the DICOM network.

- To Use the Exams List 'To Use the Exams List' *on page 14-3*
- To Select the Exams 'To Select the Exams' *on page 14-3*
- To Sort the Exams 'To Sort the Exams' *on page 14-4*
- To Search for Exams 'To Search for Exams' *on page 14-4*
- To Review the Exams 'To Review the Exams' *on page 14-5*
- To Delete Exams 'To Delete Exams' *on page 14-6*
- To Send Exams 'To Delete Exams' *on page 14-6*
- To Print Exams 'To Print Exams' *on page 14-6*
- To Export Exams 'To Export Exams' *on page 14-6*
- To Backup the Exams 'To Backup the Exams' *on page 14-7*
- To Restore the Backup Exams 'To Restore the Backup Exams' *on page 14-8*

14.1.1 To Use the Exams List



Click the **[Open]** icon and a list of the exams is displayed.



Depending on the General Setting, all the currently available Exams, or only the Exams of the last xxx days, will be listed.

Note *If “Hide exams on open” is marked with a check mark, no exams will be displayed until you click on the [Show Exam List] button on the screen.*

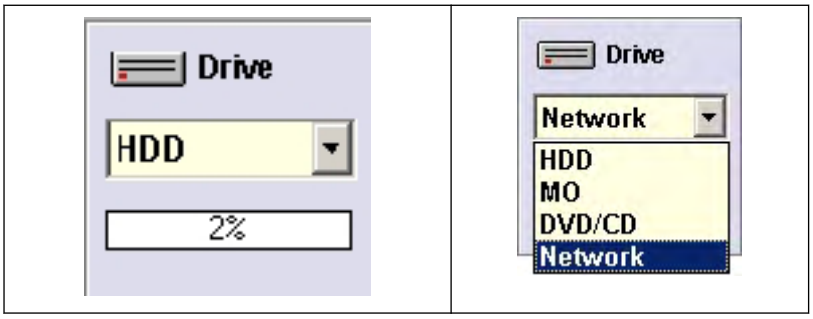
To change the display of the “Exams List” review: Settings 'Settings' *on page 14-21*

14.1.2 To Select the Exams

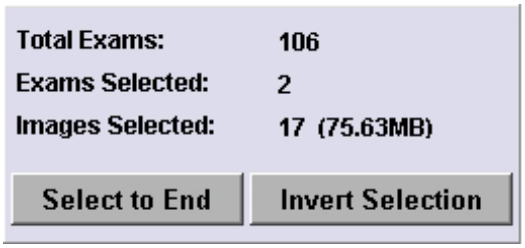
Select the Exam desired using the trackball and the right trackball key [Set].

Remarks:

- For selecting multiple exams, hold down the **[Ctrl]** or **[Shift]** key on the alphanumeric keyboard and select the desired exams using the trackball and the right trackball key [Set].
- The user can confirm the capacity of an appropriate medium.



The capacity left in each storage medium is displayed at the left and upper part of the exams list when storage medium HDD, MO, DVD/CD or Network is selected.



The number of all exams of the exam list; the number of currently selected exams, the number of images and the capacity of selected exams are displayed automatically at the right and upper part of the Exams List.

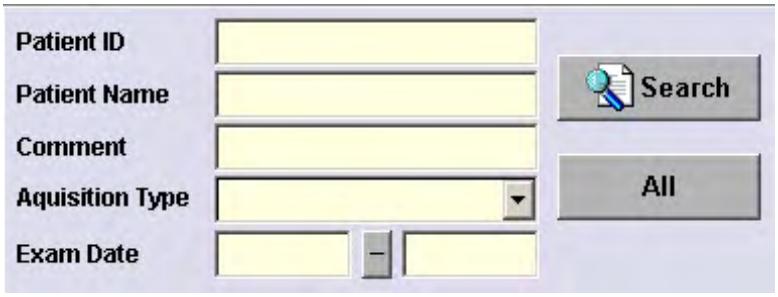
14.1.3 To Sort the Exams

Clicking on the caption of a column, the Exams List will arrange the exams on the basis of the selected captions. For example select the [Exam Date]; the arranged list will be in the order of the Exam Date.



14.1.4 To Search for Exams

After entering the requested Patient ID, Patient Name, Exam Date (designating a specially fixed date or the full day and date), click the [Search] button to search the appropriate list of exams.



Click the [All] button to see the complete list of exams saved in the designated drive.

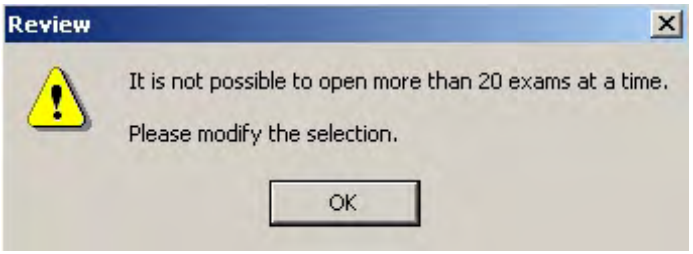
Note *It is possible to search for exams with different acquisition types (e.g. 2D, 2D Cine, 3D, 3D Rot Cine, VOL CINE, 4D BIOPSY IMG CINE.*

14.1.5 To Review the Exams



After selecting the appropriate exam(s) in the Exams List by using the trackball and the right trackball key [Set], click the [Review] button. The entire range of images of selected exams can be viewed.

Alternatively, double-click an exam directly.



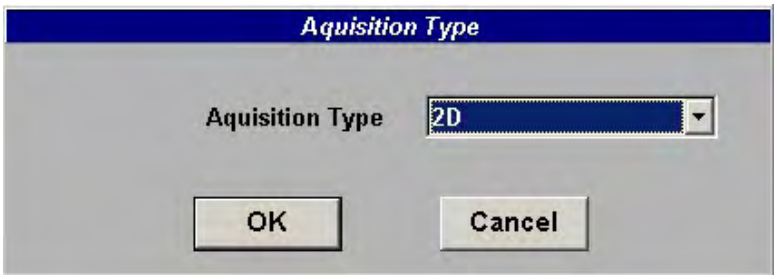
Up to 20 exams can be opened at a time. If more than 20 exams are selected, a warning appears that too many exams are selected.



In the upper right corner of the viewed image the Acquisition Type button is visible (e.g. 2D).

Click on the “Acquisition Type” Button to assign the image other Acquisition type or to delete the current type.

The “Acquisition Type” window appears:



Select desired Acquisition Type and click [OK] button to save the modification, or the [Cancel] button to cancel the modification.

14.1.6 To Delete Exams

Delete

After selecting the exam(s) to be deleted by using the trackball and the right trackball key [Set], click the [Delete] button. All images of the selected exam(s) are deleted permanently and cannot be recovered.

14.1.7 To Send Exams

Send

After selecting the exam(s) to be sent using the trackball and the right trackball key [Set], click the [Send] button. All images of the exam(s) will be sent to the selected DICOM storage destination.

For more details please refer to DICOM Send 'DICOM Send' *on page 14-18*.

14.1.8 To Print Exams

Print

After selecting the exam(s) to be printed using the trackball and the right trackball key [Set], click the [Print] button. All images of the exam(s) will be printed at the selected DICOM Printer.

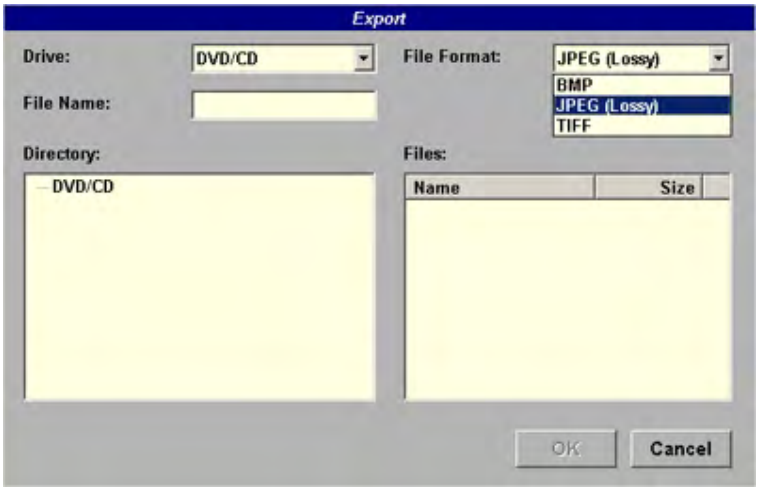
For more details please refer to DICOM Print 'DICOM Print' *on page 14-20*.

14.1.9 To Export Exams

Export

After selecting the exam(s) to be exported using the trackball and the right trackball key [Set], click the [Export] button.

The following window will be shown on the screen.



1. Assign the desired “Drive”(DVD/CD, MO or Network).
2. Enter a “File name”.
3. Select the “File Format” of JPEG, BMP or TIFF.
4. Click the [OK] button to export all the images of the exam(s) to the selected storage medium.

Attention: Apply JPEG-compression with a quality setting less than 100% to an image only once.



Images that were saved to SonoView using lossy (less than 100%) JPEG compression are clearly marked with a yellow **J** (e.g., J80 = compression factor 80%).

14.1.10 To Backup the Exams

SonoView provides the function to backup the images, patient data as well as measurements according to the standard of DICOM DIR using the optional DVD/CD+(R)W drive, USB devices or a mapped network drive.

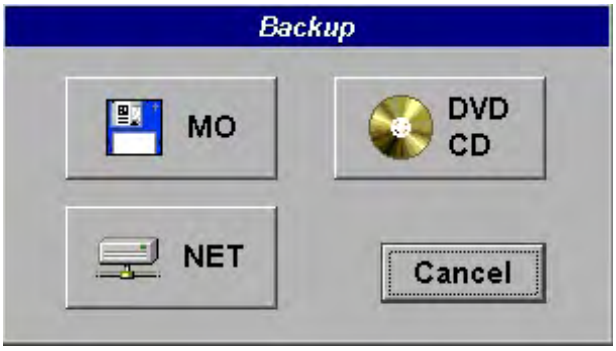


All settings and patient data created since last full backup are **NOT** backed-up! It is highly recommended to create a full backup of settings and patient data regularly.

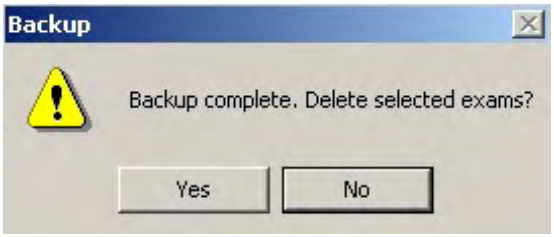
After selecting an exam to back up, insert a DVD/CD+(R)W into drive.



After the LED of the drive stops flashing, click the [Backup] button at the lowest part of the screen to display the Backup window.



Select the destination for the backup.

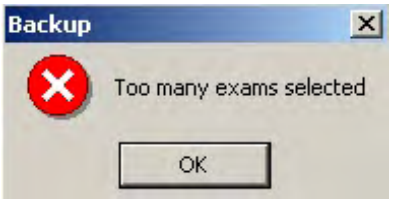


After finishing the backup of an exam, select whether the exam is to be deleted or not. If [Yes] is selected, the exam will be absolutely deleted from the hard disk of the ultrasound scanner.

You can save the exam in DVD/CD+R or DVD/CD+RW just once. It is impossible to additionally save other exams. When using a DVD/CD+RW disk, it can be used again after deletion of its contents.

Remarks:

- The capacity of a blank DVD+R or DVD+RW is 4.7GB, but the additional files for backup take some capacity. Therefore, the capacity of selected exams must not exceed 4GB.
- The capacity of a blank CD+R or CD+RW is 650MB, but the additional files for backup take some capacity. Therefore, the capacity of selected exams must not exceed 600MB.



If too many exams are selected, a warning message will be displayed on the screen.



When storage medium Network is selected, you can [Restore] the data in the exam list from the network drive to the hard disk and [Backup] to a CD or DVD.

14.1.11 To Restore the Backup Exams

If the exams are restored from a DVD/CD or MO disk, insert the cartridge in the drive and wait for the busy LED light to stop flashing.

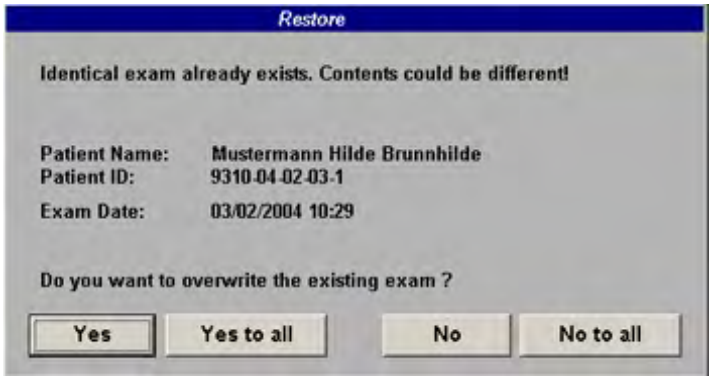


Select the DVD/CD or MO drive to see the list of exams stored on the cartridge. Select the Network drive to see the exams stored in the mapped network drive.



After selecting the appropriate exam(s), click on the [Restore] button to move the exam(s) from the selected source to the local hard disk.

Note *If an exam is about to be restored that already exists on the hard disk, a dialog shows the Patient Name and Patient ID and asks for the action to be taken.*



Yes	The exam on the hard disk is replaced with the exam in the backup. The system will ask again if another identical exam is found during the restore process.
Yes to all	All identical exams are replaced without further notice.
No	The exam on the hard disk is **not** replaced by the exam in the backup. The system will ask again if another identical exam is found during the restore process.
No to all	No identical exams are replaced with the exams in the backup.

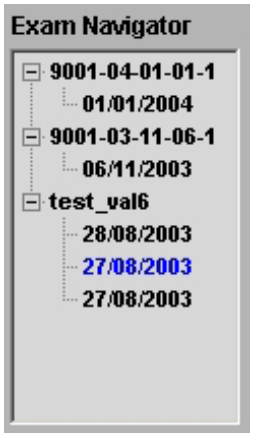
14.2 Image Review

This chapter describes how to review images.

- View Mode 'View Mode' *on page 14-10*
- Exam Mode 'Exam Mode' *on page 14-10*
- Compare Mode 'Compare Mode' *on page 14-11*
- Layouts 'Layouts' *on page 14-11*
- Full Screen 'Full Screen' *on page 14-11*
- 3D Mode 'Full Screen' *on page 14-11*

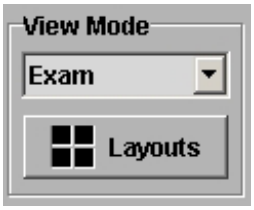
- 2D Cine Mode 'Full Screen' *on page 14-11*
- 3D Rotation Cine Mode 'Full Screen' *on page 14-11*
- 4D Cine Mode 'Full Screen' *on page 14-11*
- Images with Text Comment 'Full Screen' *on page 14-11*
- Images with Voice Comment 'Full Screen' *on page 14-11*
- Images with JPEG Compression (less than 100%) 'Full Screen' *on page 14-11*
- To Delete an Image from an Exam 'To Delete an Image from an Exam' *on page 14-13*

14.2.1 View Mode



SonoView includes the Exam Navigator for easy and quick navigation between exams or images. For example, if two exams are loaded from the Exams List, the ID and dates of the exams will be displayed at the Exam Navigator.

14.2.2 Exam Mode



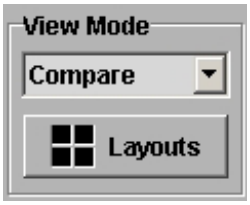
Exam Mode provides a quick and easy method of paging through the images in an exam.

The image(s) selected from the “Thumbnail Window”, will automatically be displayed on the screen.

The images from an exam are shown within a yellow box at the bottom of the screen.



14.2.3 Compare Mode



The Compare Mode is useful for comparing images.

Click to select the first image to compare from the thumbnail window. The border of that image flickers.

Place the cursor arrow at the frame where the selected image shall be located and press the right or left trackball key [Set]. The image is copied to that frame. (It is not possible to drag and drop the image.) A maximum of four images can be compared.

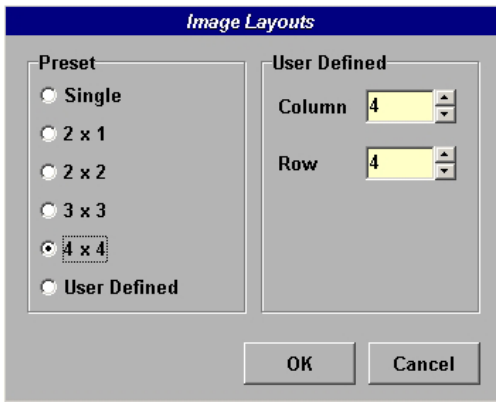
Note *Images from other exams can be compared.*

14.2.4 Layouts



To specify the layout, click the [Layout] button.

Select one of the pre-defined layouts.



14.2.5 Full Screen

One selected image from any layout can be displayed in full-screen size.

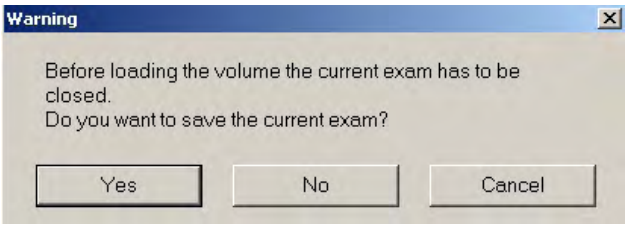
To use Full Screen View, move the cursor to the desired image and press the right or left trackball key [Set] twice. To return to normal viewing, press the right or left trackball key again twice.

14.2.5.1 3D Mode



When a 3D volume is stored (in **Voluson® i Format**), the [3D] button is displayed at the right and lower part of the image.

Click on the [3D] button and the 3D volume dataset will be displayed.



Note *If the current exam is still active, a warning message will be displayed before loading the 3D or Real Time 4D volume dataset.*

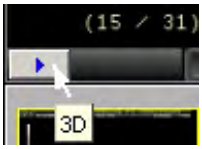
14.2.5.2 2D Cine Mode



If a 2D Cine sequence has been stored to SonoView, the buttons for cine are displayed at the left and lower part of the image.

Click the [x25BA] button, the 2D Cine-Mode will run.

14.2.5.3 3D Rotation Cine Mode



If a 3D Rotation Cine sequence has been stored (in **Voluson® i Format**) to SonoView, the [x25BA] button is displayed, and the number of saved images is displayed at the left and lower part of the image (in full screen size).

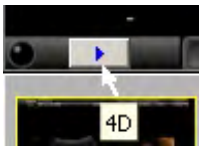


If a 3D Rotation Cine sequence has been stored (in **Multiframe** format) to SonoView, the buttons for cine are displayed at the lower left part of the image.

Click the [x25BA] button, the 3D Rot. Cine mode will run.

For details about Voluson® i Format and Multiframe review: SonoView Configuration 'SonoView Configuration' *on page 16-30*.

14.2.5.4 4D Image Cine Mode



If a 4D Image Cine sequence has been stored (in **Voluson® iFormat**) to SonoView, the [x25BA] button is displayed at the left and lower part of the image.



If a 4D Image Cine sequence has been stored (in **Multiframe** format) to SonoView, the buttons for cine are displayed at the lower left part of the image.

Click the [x25BA] button, the 4D Image Cine mode will run.

For details about Voluson® iFormat and Multiframe review: SonoView Configuration 'SonoView Configuration' *on page 16-30*.

14.2.5.5 Images with Text Comment



If images are saved with text comment, the [C] button is displayed at the right lower part of the image. To view the Comment click the [C] button.

The text can be modified or deleted (max. 40 characters).

14.2.5.6 Images with Voice Comment



If images are saved with voice comment, the [x266B x25BA] button is displayed at the right lower part of the image.

To hear the voice comment of the image, click the [x266B x25BA] button.

14.2.5.7 Images with JPEG Compression (less than 100%)



If images were saved using lossy (less than 100%) JPEG compression, a yellow sign (e.g., J80 = compression factor 80%) is displayed at the left upper part of the image.

For details about JPEG Compression review: SonoView Configuration 'SonoView Configuration' *on page 16-30*.

14.2.6 To Delete an Image from an Exam

To delete a single image from an exam, click on the desired image. The border will turn yellow.



Press the **[Del]** key on the alphanumeric keyboard.

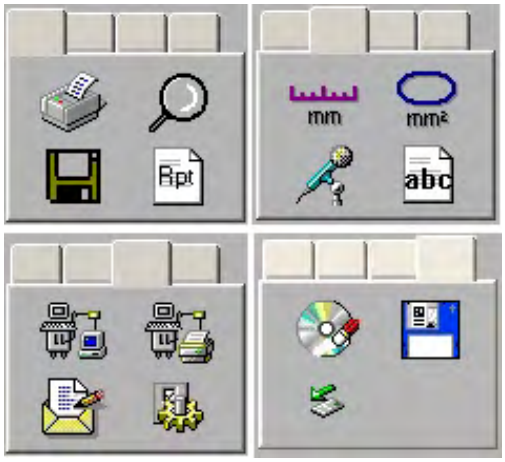
The “Delete” message box appears.



Confirm with the [OK] button or quit with [Cancel].

14.3 Tools

This chapter describes how to use all tools available in the SonoView.

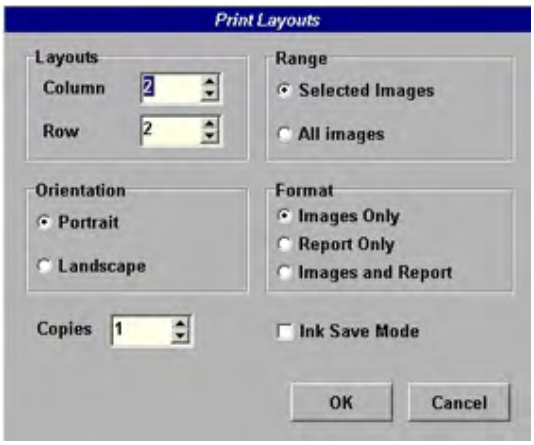


- To Print Images 'To Print Images' *on page 14-15*
- To Export Images 'To Export Images' *on page 14-15*
- To Magnify Images 'To Magnify Images' *on page 14-16*
- Report 'Report' *on page 14-16*
- To Measure Distance 'To Measure Distance' *on page 14-17*
- To Measure Ellipse 'To Measure Ellipse' *on page 14-17*
- Voice Recorder 'Voice Recorder' *on page 14-18*
- Input of Comment 'Input of Comment' *on page 14-18*
- DICOM Send 'DICOM Send' *on page 14-18*
- DICOM Print 'DICOM Print' *on page 14-20*
- To Send E-mails 'To Send E-mails' *on page 14-21*
- Settings 'Settings' *on page 14-21*
- Erasing optical media 'Erasing optical media' *on page 14-25*

14.3.1 To Print Images



This enables you printing images and a brief report.



Select the appropriate setting on the Print Layouts screen.

Ink Save Mode allows the printing of images without color background, using the black background color of the ultrasound image. Click the [Ok] button to print the image.

14.3.2 To Export Images

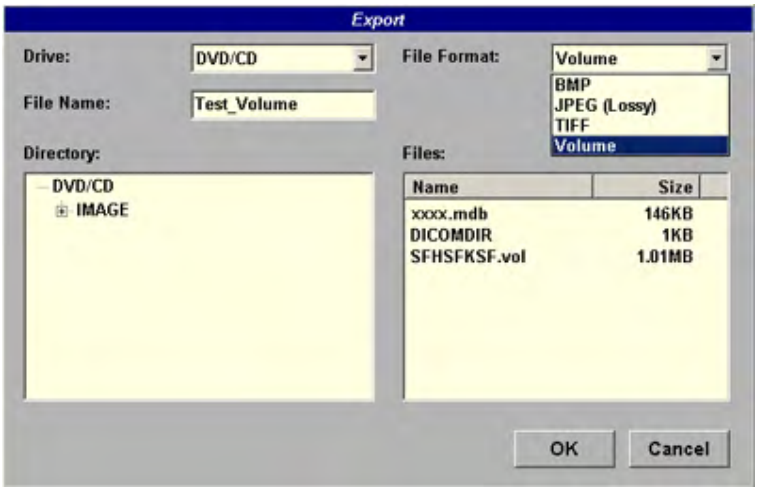


This enables the export of images in BMP, JPEG, TIFF or Volume file format to DVD/CD+ (R)W, MO disk or a mapped Network drive.

Note

- *If a 3D Volume image is selected, the complete dataset can be exported in Volume file format. The stored Volume files can be reviewed with the PC program **"4D View"**.*
- *Stored images in BMP, JPEG, TIFF can only be reviewed on an external PC.*
- *Volume files can only be exported one after the other (multiple image selection is impossible)!*

Move the cursor to the image to be exported. Then press the right trackball key [Set]. To select multiple images, hold down the **[Ctrl]** key on the alphanumeric keyboard and select each image with the right trackball key [Set].



Activate the [Export] tool. The mouse cursor appears as a floppy disk icon. The number of selected images is displayed on the screen. Click the [OK] button. After typing the directory and file name of the location to store the image, press the [OK] button to save it in BMP, JPEG, TIFF or Volume file format.

Attention: Apply JPEG-compression with a quality setting less than 100% to an image only once.



Images that were saved to SonoView using lossy (less than 100%) JPEG compression are clearly marked with a yellow **J** (e.g., J80 = compression factor 80%).

14.3.3 To Magnify Images



This enables magnification of a region of interest of an image.

When the [Magnifier] tool is active, the mouse cursor appears as a magnifier icon.

Move the cursor (icon) to the image and press the right trackball key and hold the key to activate the magnifier. Move the Magnifier (using the trackball) over the image to view the region of interest.

To cancel the magnification, release the key. To cancel the Magnifier, select the magnifier icon.

14.3.4 Report



Additional data and comments can be entered into the report of the currently selected exams.

After completing the report, click the [OK] button to save the content, or click the [Cancel] button.

14.3.5 To Measure Distance



This provides the function for measuring the distance between two points within the image.

Note *The Full Screen View must be selected; otherwise this function does not work.*

Select the [Distance] icon and move the cursor to the image. The cursor changes to a "**+**".

Place the cursor at the start point to begin the measurement, and then press the right or left trackball key [Set]. After placing the cursor to the end point that you want to measure, press the right trackball key [Set], and the distance of the two points is displayed.

Several measurements can be made in the same manner.

Click the [Distance] icon again to exit the measurement function.



Select the [Clear Measurements] button on the lower part of the image to delete the displayed measurements.

14.3.6 To Measure Ellipse



Using this function an ellipse can be drawn in an image to measure the circumference and area.

Note *The Full Screen View must be selected; otherwise this function does not work.*

Select the [Ellipse] icon and move the cursor to the image. The cursor changes to a "**+**".

Place the cursor at the start point to begin drawing of the ellipse, and then press the right or left trackball key [Set].

After placing the cursor to the opposite end point of the area, press the right or left trackball key [Set].

Now adjust the size of the ellipse by moving the trackball. Press the right trackball key [Set] after moving the trackball to adjust the shape and size of the ellipse. The circumference and area of the drawn ellipse will be displayed on the screen.

Several measurements can be made in the same manner.

Click the [Ellipse] icon again to exit the measurement function.



Select the [Clear Measurements] button on the lower part of the image to delete the displayed measurements.

14.3.7 Voice Recorder



Record a voice comment with the image.

To record voice proceed as follows:

Place the cursor in the image to comment and press the right trackball key [Set]. When the recording has started, the dialogue box and recording time is displayed as seen below.



Click the [Stop] button to finish recording.

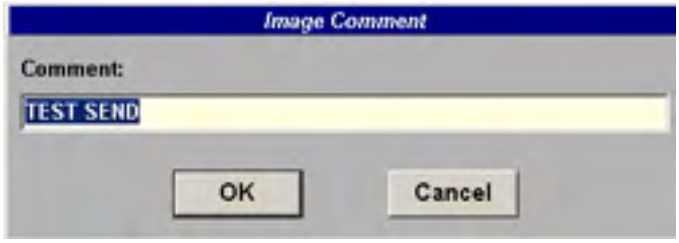
Note *There is no microphone built in and released for Voluson® i.*

14.3.8 Input of Comment



Provide the image with a text comment.

Place the cursor in the image you want to comment and press the right trackball key [Set]. Type the desired text.



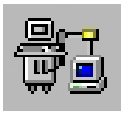
Click the [OK] button to finish the annotation.

14.3.9 DICOM Send

DICOM Selective Send

It is possible to send individual images selectively using the DICOM network.

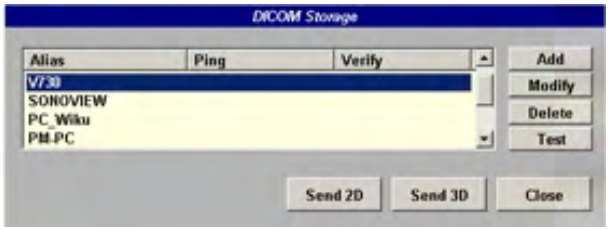
Move the cursor to the image to be sent. Then press the right trackball key [Set]. To select multiple images, hold down the **[Ctrl]** key on the alphanumeric keyboard and select each image with the right trackball key [Set].



Click this icon. The number of selected images is displayed on the screen. Click the [OK] button.



After confirming, the dialogue box is displayed as below.



Select the destination desired and click the [Send] button.

To add a new destination, click the [Add] button, enter the information and click the [OK] button.

To confirm or modify the information concerning the destination, highlight the destination and click the [Modify] button.

For further details review System Setup: To specify a DICOM Address 'To Specify a DICOM Address' *on page 16-27*

Attention:



Do not send images to a DICOM server that were saved to SonoView using lossy (less than 100%) JPEG compression. Such images are clearly marked with a yellow **J** (e.g., J80 = compression factor 80%).

An image can be sent through 4 storage servers at the same time.

Test Connection: Test the connection to a DICOM station (destination).

First select the station to be tested using the right or left trackball key, then click the [Test] button. If the TCP/IP connection to the remote station is active, the entry "Normal" will appear in the [Ping] column. If the DICOM server on the remote station is active, the entry "Normal" will appear in the [Verify] column.

This connection test may take up to 30 seconds.

After completing the procedure, click the [Send] button. The selected exam is sent to the destination by the system.

14.3.10 DICOM Print

DICOM Selective Print

It is possible to print out image(s) selectively to a printer that is connected to the DICOM network.

Move the cursor to the individual image which to be printed. Then press the right trackball key [Set].

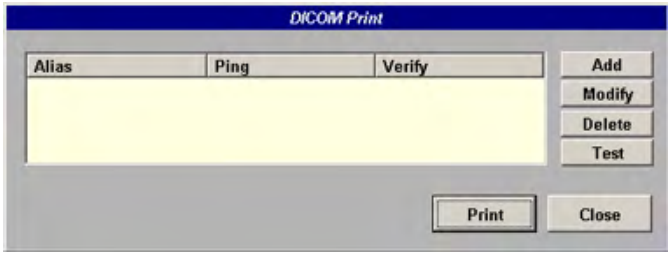
To select multiple images, hold down the **[Ctrl]** key on the alphanumeric keyboard and select each image with the right trackball key [Set].



Click this icon. The number of selected images is displayed on the screen. Click the [OK] button.



After selecting [OK], the dialogue box is displayed as seen below.



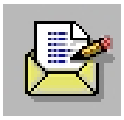
To print the image to the DICOM Printer select the destination desired and click [Print].

To add a new printer, first click the [Add] button. Enter the corresponding information and then click the [OK] button.

To modify that information about the printer, highlight the Printer and click the [Modify] button.

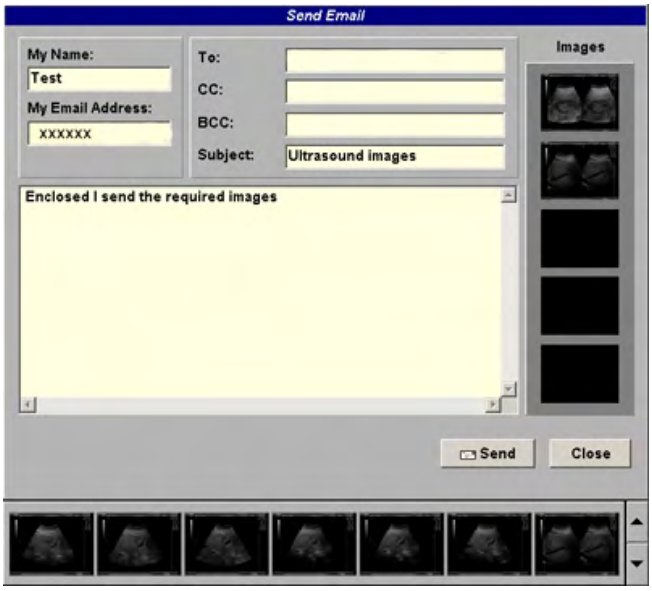
Refer to the manual of the printer and DICOM Conformance Statement for detailed information.

14.3.11 To Send E-mails



SonoView provides the function to send images attached to E-mails.

Click the [E-mail] icon and enter the E-mail address, Subject and Content.



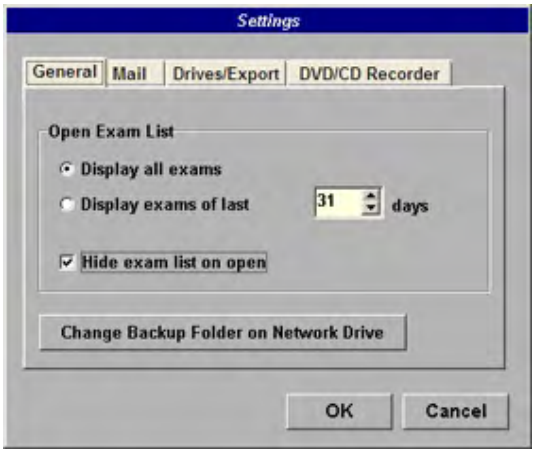
Move the cursor to the desired image in the Thumbnail window to be sent. Then press the right trackball key [Set]. The border of that image flickers. Move the cursor to the images window within the E-mail format and press the right trackball key [Set]. Viewing of the selected image(s) verifies that they are attached. After attaching more images in the same manner, click the [Send] button to send the E-mail.

14.3.12 Settings



The settings consist of four adjustments:

14.3.12.1 General



Select the “Open Exams List” display:

- Display of all Exams or
- Display Exams of last xxx days

Note *If the display is restricted to a few days, the loading time of the exams list is abridged.*

To ensure patient data protection, select “Hide exams on open”.

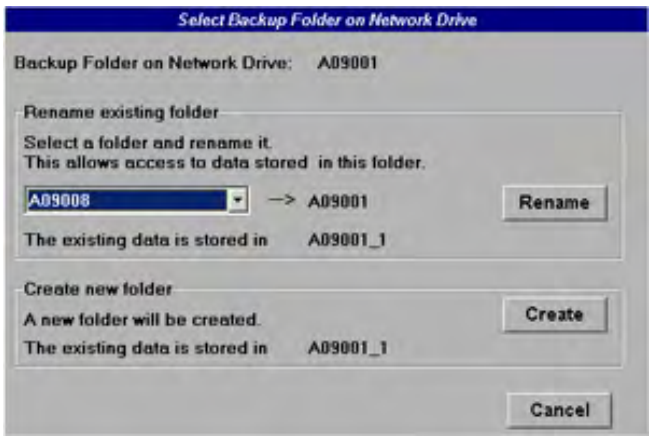
Change Backup Folder on Network Drive

This functionality can be used to take data from other sources (Voluson® i or 4D View) and use it on the current application.



Select this button (in the Settings - **General** page).

Following dialog appears:



Using the mapped network drive, it is possible to store SonoView image data to a folder on a server; review also: Map Network Drive 'Map Network Drive' *on page 16-37*. However, more than one system could be exporting data to a particular server. To avoid data corruption caused by colliding write operations, every system creates its own “Backup Folder” where it stores the data. Below this folder lies the backup data.

The first line in the dialog (see image above) displays the name (e.g., serial number A09001) of the “Backup Folder” used for storing data on, and reading data from the network drive. If the system is connected to a network drive, all export and import operations will be executed on this “Backup Folder”.

For example:

a system with the serial number A09001 has the backup folder A09001, and a system with the serial number A09008 has the backup folder A09008

Note *A system can only access its own “Backup Folder” that corresponds to its serial number.*



With the [Create] button, it is possible to create a new working folder, preserving the existing data. The current backup folder is renamed such that it has a number at the end of the serial number.

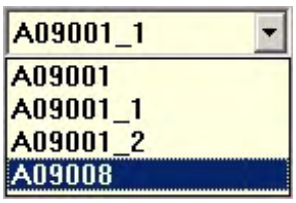
For example: If a new backup folder for the machine A09001 should be created, the previously existing folder is renamed to A09001_1. This folder now contains all the data. A new, empty backup folder is created, having again the name A09001.

All operations are now performed on the new empty backup folder A09001. Subsequent [Create] operations increase the number at the end, e.g. A09001_2, A09001_3 and so on).

The data stored in the numbered folders (e.g. A09001_1 and A09001_2) can be moved back into the place of the backup folder. First, the content of the current backup folder (e.g. A09001) is stored to a new numbered folder (A09001_3). Then, the selected folder (e.g. A09001_1) is renamed to be the new current backup folder (A09001).

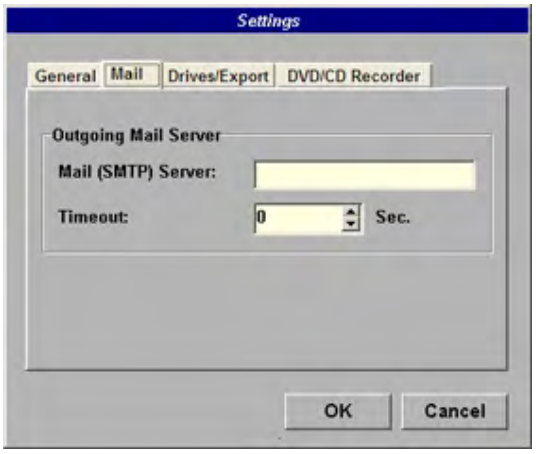


This operation is done with the [Rename] button. The drop-down list shows all data folders; both, backup and numbered ones. The folder selected here will be put in the place of the current backup folder, as described above.



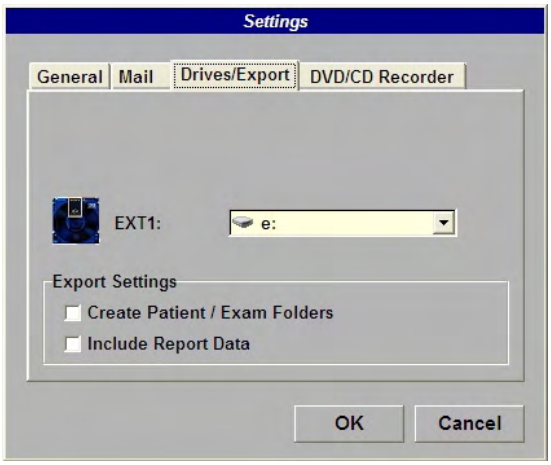
The drop-down list shows all folders on the network drive. If a folder is selected to be renamed (e.g., A09008, which contains the backup data from a different system), it is not copied, but simply renamed. Thus, the same data can be shared between two machines by renaming the respective backup folders to the serial number of the accessing system.

14.3.12.2 Mail



Designate the Outgoing Mail Server and Timeout.

14.3.12.3 Drives/ Export



EXT1

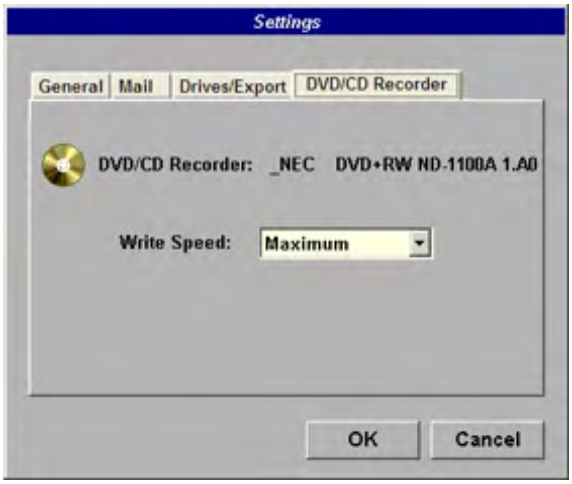
Define one of the internal and external drives from the dropdown list as EXT1.

Export Settings

Create Patient and Exam folders The given file name will be omitted and instead a directory structure with the patient name as directory name will be created in the export location.

Include Report Data Check this item to export report data in ".txt" file format.

14.3.12.4 DVD/CD Recorder



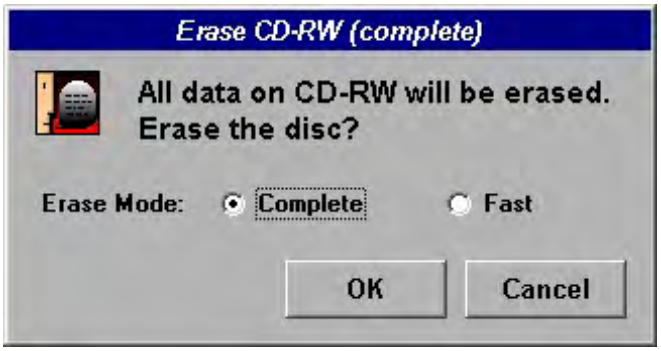
Readjust the Write Speed of the DVD/CD Recorder (DVD/CD Writer).

14.3.13 Erasing optical media

This allows erasing of a DVD+ RW /CD RW disc. Insert the medium and select the disc icon.



By selecting the disc icon the unit displays the Erase DVD/CD window.



Select the “Erase Mode” and click the [OK] button to start the format process.

Remark:

When using a DVD+ RW, the complete erase mode is not available.

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Chapter 15

Export & Print

This chapter contains information of the P-keys an how to programm them for printing, saving and exporting data.

Export & Print

- To print images review: Printing 'Print' *on page 15-4*
- To print images to a DICOM Printer review: DICOM Print 'Print' *on page 15-4*
- To save images review: Saving 'Save' *on page 15-6*
- To send images via DICOM review: Sending Images to a DICOM Server 'Export' *on page 15-8*

15.1 Programmable keys

On the user interface there are three keys which are programmable in the system setup for exporting and printing data. Each key can be programmed for different actions. To programm the P-keys 'To programm the P-keys' *on page 15-2*



15.1.1 To programm the P-keys



Press the [Utillities] key to enter utillitiesmenu.

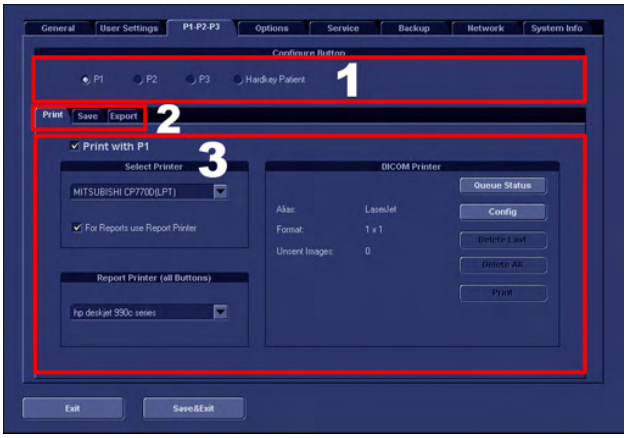
Select [System] for entering the systemsetup.



Select [P1-P2-P3] menu.



Now you are in the [P1-P2-P3] menu:



1. P-keys:	Select the keys you would like to program.
2. Key actions:	Choose the action you want the key to do.
3. Adjustments	Adjust the actions individual.

Three actions can be programmed on each P-key:

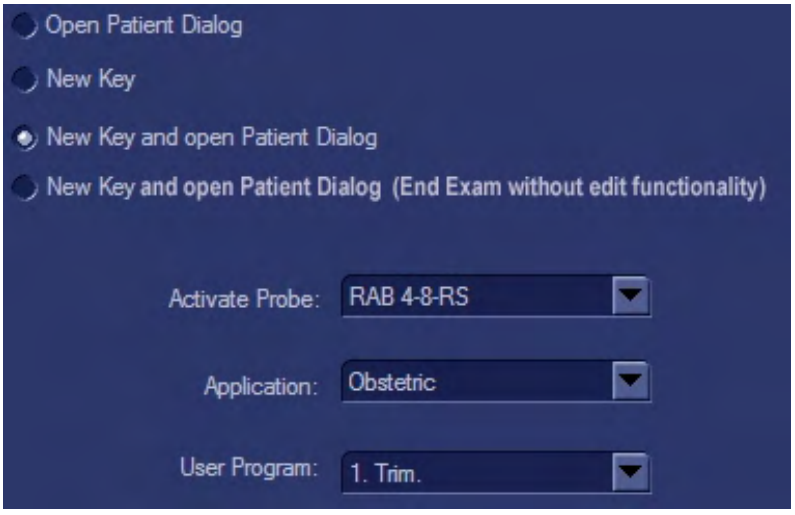
- Print ('Print' *on page 15-4*)
- Save ('Save' *on page 15-6*)
- Export ('Export' *on page 15-8*)

15.1.2 To program the Patient hardkey

15.1.2.1 Introduction



The **Patient** key can be programmed to act as “New” key.



15.1.2.2 Settings

Open patient dialog	Default setting
New key	Activate this setting to use the “New Patient” key.
New key and open patient dialog	Activate this setting to use the “New Patient” key and additionally invoke the patient dialog and the Patient ID menu from which you can start a new exam as well as edit, end or delete the current one.
New key and open patient dialog (End Exam without edit functionality)	Activate this setting to use the “New Patient” key and additionally invoke the patient dialog. The current exam is ended automatically.

To define a connected probe to be active upon exam start, select it from the ***Activated Probe*** dropdown field. Additionally, a default ***Application*** and ***User Program*** can be selected. Select ***last Used*** from the dropdown field to activate the previously used probe, application and user program.

15.1.2.3 To use the “New” key

Press the "New” key to start a new exam in 2D mode with the specified probe in “Run” mode.

Additionally the following settings are deleted:

- All measurements
- All measurements stored in the report
- All measurement graphics
- All checkmarks for inclusion of measurements in the report
- All bodymarks, texts and indicators

15.2 Print

If you programm a P-key on printing it will automatically print on the chosen printer. To select a printer you have to define a printer in the DICOM configurations. *For more information see* 'Printer configuration' *on page 15-4.*

15.2.1 Printer configuration

For printer configuration you have to enter the [Network] menu.

For more information see 'DICOM Configuration' *on page 16-26.*



Select they P-key you want to programm:

In the adjusment section select [Print with...], this button is now programmed on printing.



15.2.1.1 Printers



Select Printer: In this dropdown menu are all printers listed which are installed on the system. Select a printer for printing on the P-key. This printer prints what can be seen on screen.

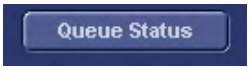
If you want to use a different printer for report-printing select [For Reports use Report Printer] and select the printer for the reports in the lower dropdown field.

The report printer will print the whole worksheet, as it prints a pdf-version of the worksheet.

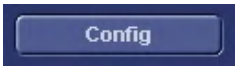
15.2.1.2 DICOM Printer configuration

Check all Printer configurations in the [DICOM Printer] section:





Select [Queue Status] to enter the Printer status menu: 'DICOM Queue Status' *on page 16-32*



Select [Config] to enter the Printerconfig menu: 'To Specify a DICOM Address' *on page 16-27*

Press [Save&Exit] to exit the menu and save all adjustments,

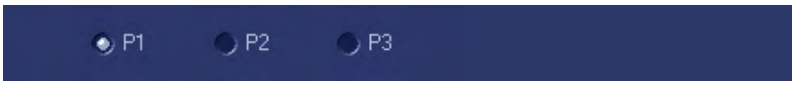


or [Exit] to exit the menu without saving.

15.3 Save

To save images, patientdata and cineloops you have to programm a P-key. It is possible to store data in the internal Archive or on a external DICOM destination.

Select the P-key that you want to programm:



Select [Save with...] to programm the key on saving data:



If the programmed P-key is pressed the saving progress status is show on the right-bottom side of the screen.



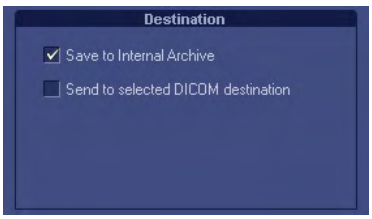
[Saving in progress] is shown as long as the system saves the data.

Note *If no exam is is created, you will be asked to create a patient exam when you want to save the data. The patient screen opens automatically.* 'Entering Patient Data' *on page 4-6*

Note *Cine Loops are only saved, when playing back the loop!*

15.3.1 Destinations

Select the destinations you want to save on:



Choose the saving destination:

- **Save to Internal Archive**

The data will be stored in the internal archive SonoView: *Chapter 14*

You can save images, cineloops and 3D/4D informations in SonoView. To save 3D/4D information 'Options' *on page 15-7*

Note *Cine Loops are only saved, when playing back the loop!*

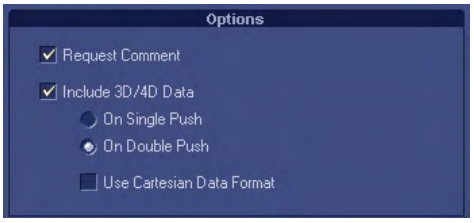
- Send to Selected DICOM destination

The data will be stored on an external DICOM destination, like an external harddisk.

To save it, a DICOM destination has to be defined; 'To Specify a DICOM Address' *on page 16-27*

Note *Cine Loops are only saved, when playing back the loop!*

15.3.2 Options



15.3.2.1 Request Comment

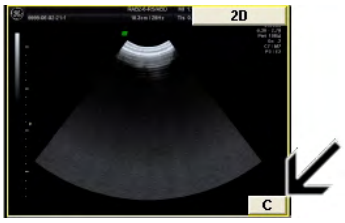


If [Request Comment] is marked you will be asked to write a short comment to the data you are going to save.

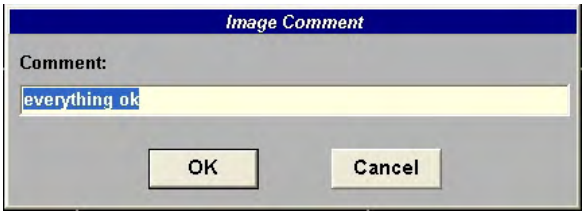


Save the comment by pressing [OK] or press [Cancel] - data will be stored without comment.

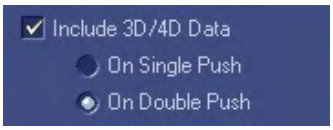
The comment will be shown in the SonoView, on the right-bottom of the image:



By clicking on the comment button the comment will be shown and can be edited. Save the comment by clicking [OK] or cancel it with [Cancel].



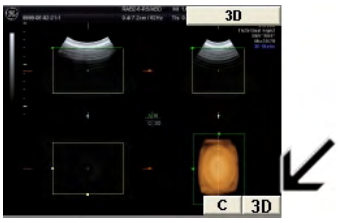
15.3.2.2 Include 3D/4D Data



If you want to save the 3D/4D data of a Volumescan mark the checkbox of [Include 3D/4D Data].

All data will be saved in your selected destination and can be opend again.

In SonoView 3D data can be restored by pressing the [3D] button on the right bottom of the image.



The 3D data can be stored:

- On Single Push

The data will be stored if the P-key is pressed one time.

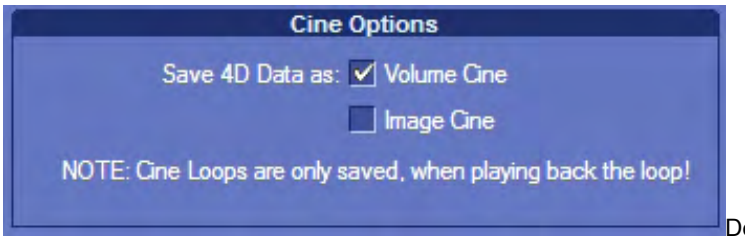
- On Double Push

The data will only be stored if the P-key is pressed double.

15.3.2.3 Use Cartesian Data Format



15.3.3 Cine options



Define if either a Volume Cine (a series of volumes), an Image Cine (a series of 2D pictures) or both should be saved after pressing the assigned button.

15.4 Export

You can export images and sequences on the Voluson® i.

15.4.1 Storing AVI-Files

With this function the following sequences are stored as AVI-files to a selectable destination:

- 2D Cine (Sequence of 2D-images or 2D/CFM-images)
- 3D Rot Cine (Sequence of a rotating 3D-image)
- Image Cine (Sequence of 4D Real Time acquisition)

Storing images with graphic is only possible if the above sequences are available.

15.4.2 Storing JPEG-Files

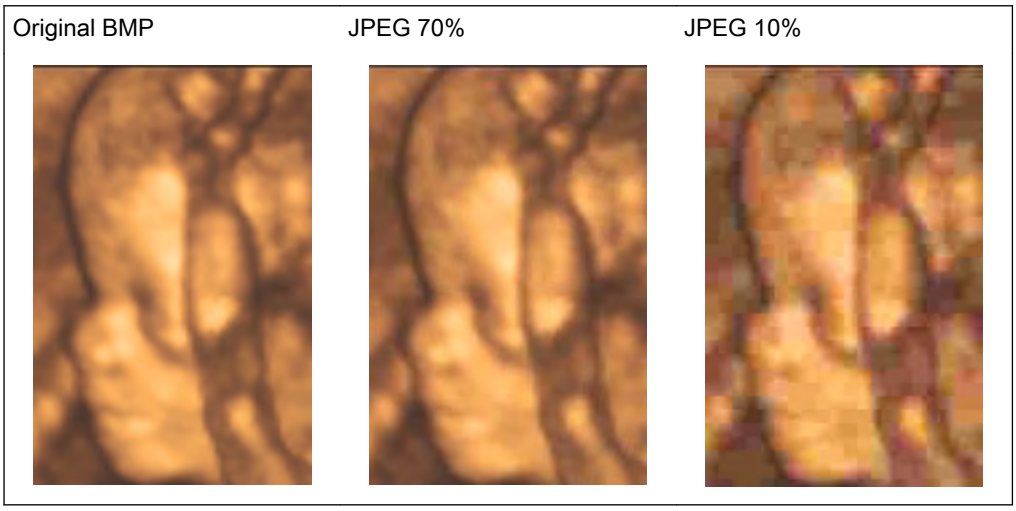
With this function current image is stored as JPEG-file to a selectable destination.

The quality and size of the JPEG-file is depending on the defined quality-percent.



15.4.2.1 JPEG compression method

Ultrasound images consume a lot of the system's memory resources. Therefore, the JPEG compression method can be applied to images to reduce their size.JPEG is a lossy compression method (e.g., an image using JPEG compression differs from the original in that it contains less information).JPEG chooses to eliminate information that the naked human eye is not very sensitive to.The quality level (100% to 80%) controls the amount of data being eliminated.If the quality parameter is set to 100%, the differences are invisible to the naked eye.



15.4.3 Destinations for Export

Export is only possible to external devices. It is not possible to export to the internal HDD.

The Export function creates a folder volusonExport on the selected drive if not already present.

JPEG Files are named [PatId]_[nnn].jpg; if PatId is missing, the Voluson_I is used as prefix.AVI Files are named [PatId]_[mmm].avi; if PatId is missing, Voluson_I is used as prefix.

Nnn and mmm are subsequent numbers starting from 000.

15.4.3.1 Writing to CD/DVD

When writing to CD/DVD, the User Interface is blocked. No user operation is possible until the write process has finished.



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Chapter 16

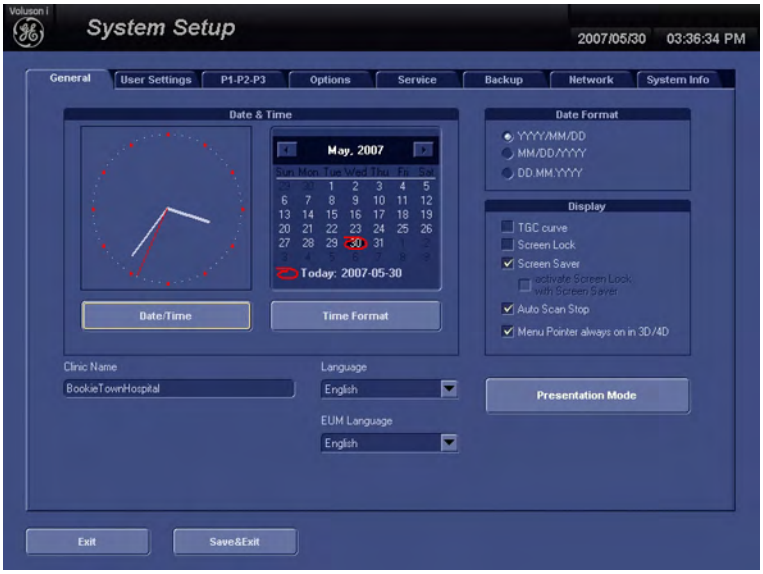
System Setup

Describes the System Settings.

16.1 Introduction

Diverse dialog pages and windows on the system setup desktop support modifications of system parameters.

System setup desktop: for example the opened page: "General"



In general operations are done with the trackball and the trackball keys (mouse emulation).



Trackball (mouse position): positions the pointing device (arrow) on the desktop



left trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device



upper trackball key (right mouse button): no function in system desktop



right trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device

16.1.1 To invoke the Setup Procedure

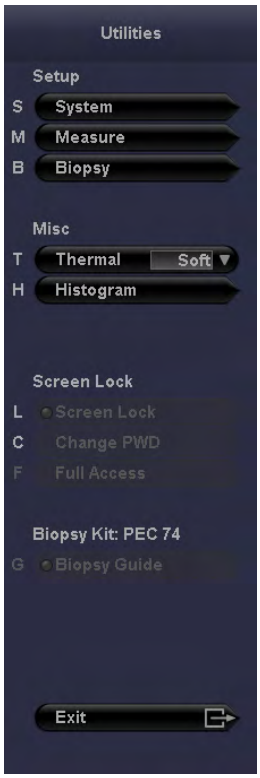
To invoke the Setup procedures select the [System] item in the menu "Utilities" to activate the setup desktop on screen.

Operation:



Press the **[Utilities]** key on the control panel.

The menu area changes to the Utilities menu.





Select the [System] item.

16.1.2 To exit from the Setup Procedure



Select the [Exit] button with the mouse pointer (arrow) and press [Set] (right/left trackball keys). Setup changes are cancelled and not saved.



Select the [Save&Exit] button with the mouse pointer (arrow) and press [Set] (right/left trackball keys) Setup changes are saved.

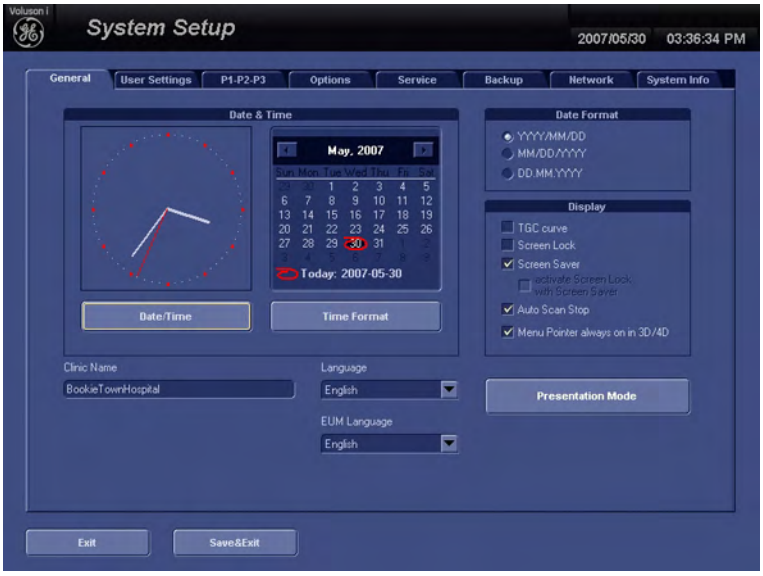
16.1.3 The System Setup Desktop Pages

The System Setup desktop offers different Pages:

- General 'General' *on page 16-4*
- User Settings 'User Settings' *on page 16-8*
- Peripherals 'P1-P2-P3' *on page 16-14*
- Option 'Options' *on page 16-14*

- Service 'Service' *on page 16-16*
- Backup 'Backup' *on page 16-16*
- Network 'Network' *on page 16-25*
- System Info 'System Info' *on page 16-38*

16.2 General



Date Format:

Activate the corresponding option button (only one can be active) to select the order of the date format desired (day-DD, month-MM and year-YY).

Display: (each button is an on/off switch)

Activate the desired option buttons.

TGC curve:

TGC-graphic display on/off.

Screen saver:

on: 5 min after last operation the screen saver starts. off: Press any hard key.

Auto scan stop:

2 min after the last operation the system activates the Read-Mode, if not yet active.

Beeper off:

switch off the “Beep” sound which is audible when pressing system hard keys

Clinic Name:

Select the text box to enter a new clinic name and use the keyboard to enter information. The clinic name will be copied into the Hospital ID in the information header of the screen, after closing the setup with [Save&Exit].

Language:

Open pop up menu and select the language desired.

Note *Only languages available on the system are listed. If a new language is installed, it is automatically added to the list.*

After [Save&Exit] the system will prompt with a dialog box to reboot the system.

There is a National Language Support for the whole measurement package (generic and calculation measurements, Measurement setup and worksheets/reports).

After changing a language the system must be rebooted!

EUM Language:

Open pop up menu and select the language desired.

This selection is not influenced by general language selection and vice vesa.

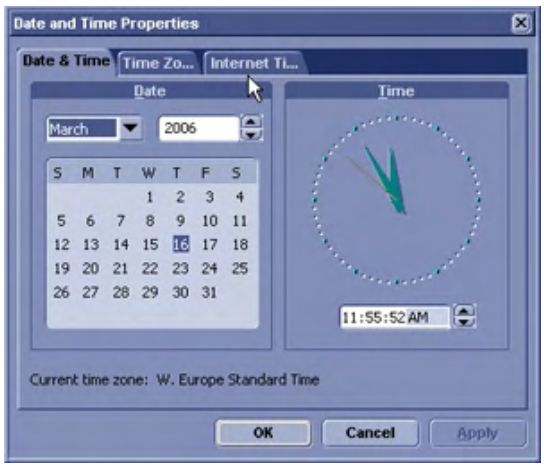
Only languages available on the system are listed. If a new language is installed, it is automatically added to the list.

16.2.1 To Enter Date, Time and Time Zone



Select the [Date/Time] button to activate a sub-dialog window to enter date, time and time zone.

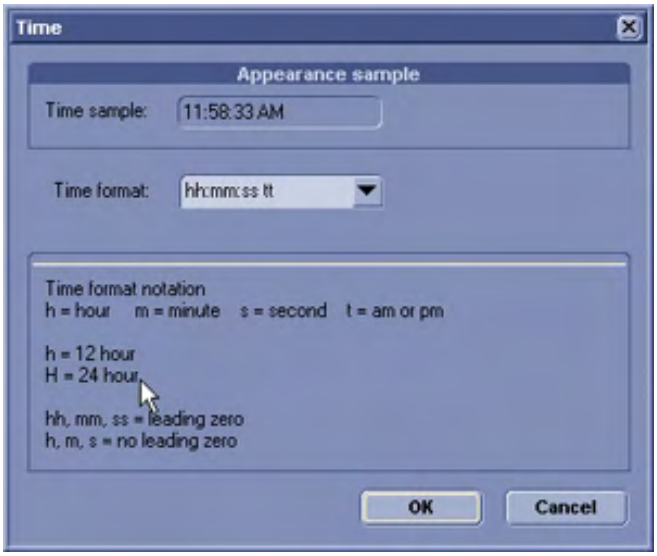
Close the sub-window with [Ok] or [Cancel] to return to the "Setup Page".





Select the [Time Format] button to activate a sub-dialog window to choose the preferred time format.

Close the sub-window with [Ok] or [Cancel] to return to the “Setup Page”.



16.2.2 Presentation Mode



The Presentation Mode loops through all Cines and Images in the Archive and displays them for a given time interval. It also supports copying media from and to USB devices and copying from CDs and DVDs (external DVD drive required). Its main purpose is for presenting slideshows e.g. on trade shows and other marketing events.

Press the ***Presentation Mode*** button to display the following dialog box:



Image duration Set the time period for displaying still images.

Drive Select the source of external images and cines from this dropdown field.

File browser The filesystem of the external source is displayed on the left, local files are displayed on the right side.

Note *Only supported file types are shown in the file browser. Currently supported file types are ".jpg" for still images and ".avi" for cines.*

To copy files from an external source:

1. Select the source drive from the ***Drive*** dropdown menu.
2. Select the desired files from the left scrollbox (or press ***Select All*** to select all files in the current folder). A preview of the selected file is shown.
3. Click the arrow button ***--->*** to copy the files to the local drive.

The same process, inverted, applies to copying files from the local drive to the external USB device.

Note *It is not possible to copy files from the local drive to an external optical drive.*

To delete external or local files select them in the file browser and press the ***Delete*** button.

Click ***Start*** to start the slideshow directly from the dialog or press ***OK*** to confirm changes. To abort the operation press ***Cancel.***

To start the slideshow anytime from outside the Presentation Mode dialog press **Ctrl+Alt+I**. It loops infinitely until **Ctrl+Alt+I** is pressed again.

16.3 User Settings



Steering Angle:	If the selected probe supports steering the possible angles are displayed. If the selected probe does not support steering, the input field remains gray (disabled).
Calculate DOC by GA:	If selected (check mark visible), the day of cycle (DOC) is automatically calculated when the gestational age (GA) is entered in the "Patient Information" screen; review: '"Patient Information" screen' *on page 4-9*.
Calculate Day Of Cycle by LMP:	If selected (check mark visible), the day of cycle (DOC) is automatically calculated when the last menstrual period (LMP) is entered in the "Patient Information" screen; review: '"Patient Information" screen' *on page 4-9*.
Capitalize Letter in Patient Names:	If "Capitalize Letter in Patient Names" is selected (check mark visible), the first letter in the "Name" fields (last, First, and Middle Name) in the Patient Information screen will be automatically capitalized. review also: Entering Patient Data 'Entering Patient Data' *on page 4-6*
Start Exam:	Depending on the selection, the "Patient Information" screen is, • saved to SonoView and/or • sent to an external DICOM server and/or • printed to an DICOM printer when selecting [Start Exam] (resp. [Continue Exam] in "Edit Patient Info"). Check "Reopen exam up to 24h" to replace the "Start Exam" button with a "Reopen Exam" button in the Patient Information Dialog if the exam has been performed within the last 24 hours.

Note *Send to DICOM Server" can only be selected if a "Service: STORE" destination is specified; "Send to DICOM Printer" can only be selected if a "Service: PRINT" destination is specified review: To specify a DICOM Address* 'To Specify a DICOM Address' *on page 16-27.*

Auto Start Acquisition:	If this checkbox is checked, the system automatically starts a new acquisition in 2D Mode when Start Exam is pressed, without displaying the dialog “Start Exam with old ultrasound Image?”. If this checkbox is not checked, the dialog is displayed as described in Standard Input 'Standard Input' *on page 4-17*	
2nd Pat. ID:	Default setting is "Off". If regulations in your country demand that you file your patient data with a national identification number, select it from the dropdown list. If your country"s system is not explicitly supported use either "Letter and Number" (no special characters allowed) or "Any" (all characters allowed).	
Overview Window:	Position:	Off, Left Top, Left Bottom (default), Right Top or Right Bottom
	Size:	Large, normal (default) or small
Document Start position:	This set-up tool defines the start position of the write cursor when switching the **[ABC]** function on. The write cursor in the graphic display shows the current set-up position. To change the current document start position: Choose a new position with the mouse cursor and press [Set] (right/left trackball key).	
User programs:	review: To Save an User Program 'To Save an User Program' *on page 16-10*	
3D/4D programs	review: To Save a 3D/4D Program 'To Save a 3D/4D Program' *on page 16-11*	
Text auto:	review: To Enter/Overwrite Text Auto 'To Enter/Overwrite Text Auto' *on page 16-12*	
Trackball Speed:	review: To Adjust the Trackball Speed 'To Adjust the Trackball Speed' *on page 16-13*	
Doppler 2D Refresh:	Activates the frozen 2D image in Doppler Mode during movement of the trackball	
End Exam Dialog:	If “End Exam Dialog” is selected (check mark visible), the system screen displays a dialog message ”*Do you really want to “End Exam”?”* when the [End Exam] key/button is pressed. For further details review: End Exam ' End Exam' *on page 4-7*.	
Use 2D Color for STIC:	If “Use 2D Color for STIC “ is selected (check mark visible), the system uses the 2D color settings for STIC color. If this box is unchecked, the system uses the color settings from the STIC user programs.	
SRI for Render	Define if SRI should be applied to rendered images.	
Clear text on unfreeze	Define if image annotations should be cleared automatically after the system is set to *Unfreeze.*	
Enable HI on Color, Power and HD Flow	By default, Harmonic Imaging is disabled when entering a flow mode. Mark this checkbox to change this behaviour.	
Foot Switch Configuration	You can assign one of the following functions either to the right or left foot switch: Update 2D, Freeze, Vol. Start, P1, P2 or P3.	
Menu - Brightness:	Pop up menu to customize the brightness of the menu display on the screen.	

Dialog color Level:	Select the desired color level for the dialogs of the user interface (e.g. System Setup, Worksheet, Patient Information, ...) Following selection are possible: Brightest, Bright, Standard (Light Text), Standard (Dark Text), Dark (Default), Darkest
LCD Brightness	Set the brightness level of the LCD Screen.
Backlight Brightness	Set the brightness level of the User Interface.
Title Bar Setting:	
Font Size:	Select the font size used in the title bar (small, medium or large)
Font Brightness:	Select the brightness of the letters in the title bar (100%, 90% or 80%)
Display DOB	Check this item to display the the current patient's date of birth in the title bar.
Zoom key	
HD-Zoom	Set HD-Zoom as default zoom mode.
Pan Zoom	Set Pan-Zoom as default zoom mode.

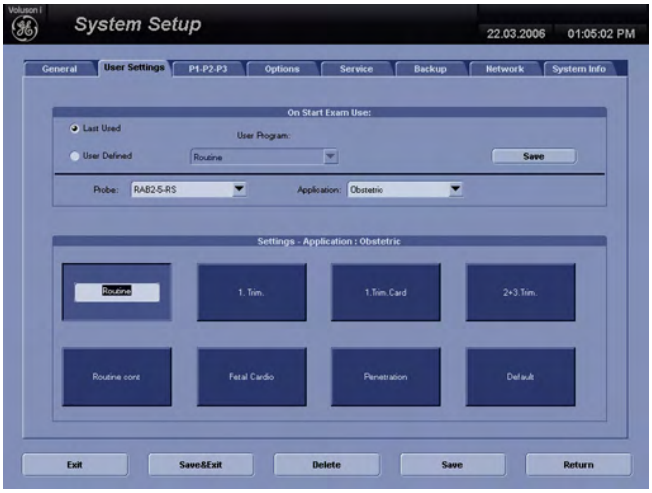
16.3.1 To Save an User Program

This tool saves the current settings of the system under a program key.



Select the [User programs] button (in the System Setup – **User Settings** page).

The "Settings" menu appears on the monitor.



Note *It is possible to select which user program shall be started when a new exam is created.*

Setting – Application:

1. Select a program button and press [Set] (labeling area and cursor are displayed inside).

2. Enter a new program label using keyboard or overwrite the existing label or don't change an existing program label, if the same term is desired.

3. Select [Save] or [Save&Exit]. The program parameters are saved in the database.

Exit: Back to the last active menu without saving.

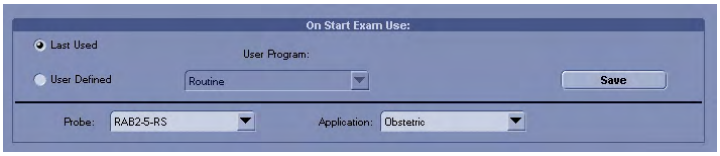
Delete: To delete stored settings from the database.

Save: To save settings with the active Settings select menu.

Return: Back to the User Setting main menu.

Default: A change of the default setting is protected by a password. The User cannot change the label “Default”.

On Start Exam Use:



For each application and probe combination select whether to use:

- last Used: On start exam the last used user program is reloaded. (Default)

- User Defined: On start exam the user program selected from the drop down list is used.

(Per Default the first item in the list is selected)

1. Select a user program in the user programs drop down list. This list contains all user programs available for the selected application/probe combination.

Note *Select default in the user program menu. The probe and application currently used on the system are selected in those lists when entering the user program dialog.*

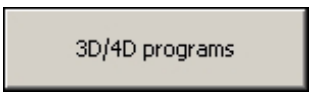
2. Select the Probe in the probe drop down list. This list contains all probes currently connected to the system.
3. Select the application in the application drop down list. This list contains all applications available for the selected probe.



Select this button to save current settings for the selected probe and application combination.

16.3.2 To Save a 3D/4D Program

This tool saves current 3D/4D settings of the system under a 3D/4D program key.



1. Select the [3D/4D programs] button (in the System Setup – **User Settings** page).

Note *Only available after a 3D acquisition.*

The “3D/4D Settings” menu appears on the monitor.

2. Select a program button and press [Set] (labeling area and cursor are displayed inside).

3. Enter a new program label using keyboard or overwrite the existing label or don’t change an existing program label, if the same term is desired.

4. Select [Save] or [Save&Exit]. The program parameters are saved in the database.

Exit: Back to the last active menu without saving.

Delete: To delete stored settings from the database.

Save: To save settings with the active Settings select menu.

Return: Back to the User Setting main menu.

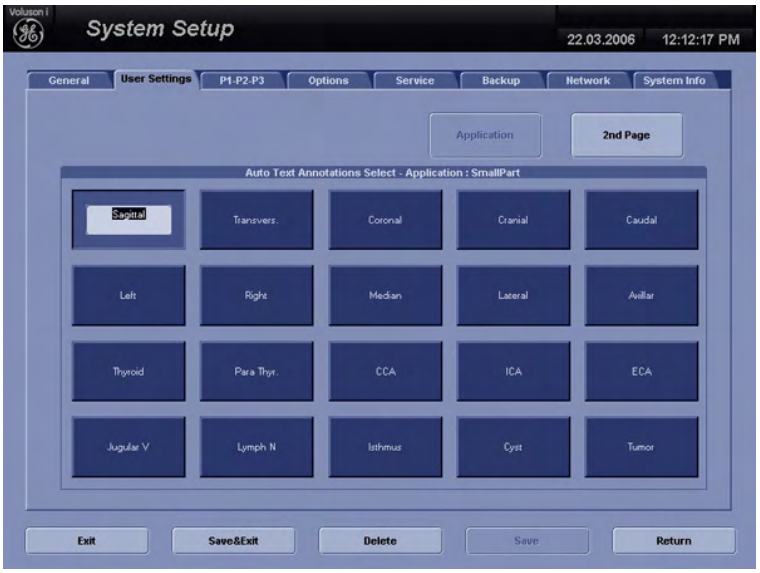
Default: A change of the default setting is protected by a password. The User cannot change the label “Default”.

16.3.3 To Enter/Overwrite Text Auto



1. Select the [Text auto] button (in the System Setup – **User Settings** page).

The “Auto Text” menu appears on the screen.



2. Select an Auto Text button and press [Set]. The cursor appears inside the selected button.

3. Enter the Text with the keyboard.

4. Select the next Text button and so on ....

5. If more than 20 entries are done, a 2nd page is available.

6. Click [Save&Exit] to store and close the System Setup.

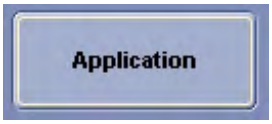
Exit: Back to the last active menu without saving.

Delete: To delete an entered word from the database.

Save: To save a word with active Auto Text (page) menu.

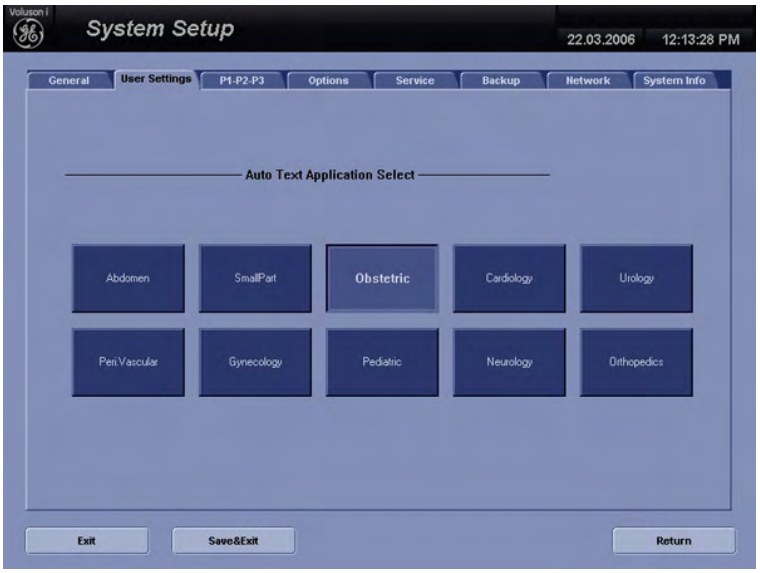
Return: Back to the User Setting main menu.

2nd Page/1st Page: This key alternates between the first and second text page.



This button changes to the Auto Text Application select menu.

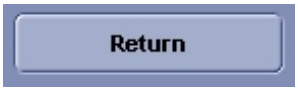
The “Auto text Application select” menu appears on the monitor.



Operation:

1. Open the Application window with the [Application] button.
2. Choose the application desired (select the corresponding application button).

After a selection the first Auto Text page of the selected application appears on the screen.



Click [Return] to return to the previous Text Auto page.

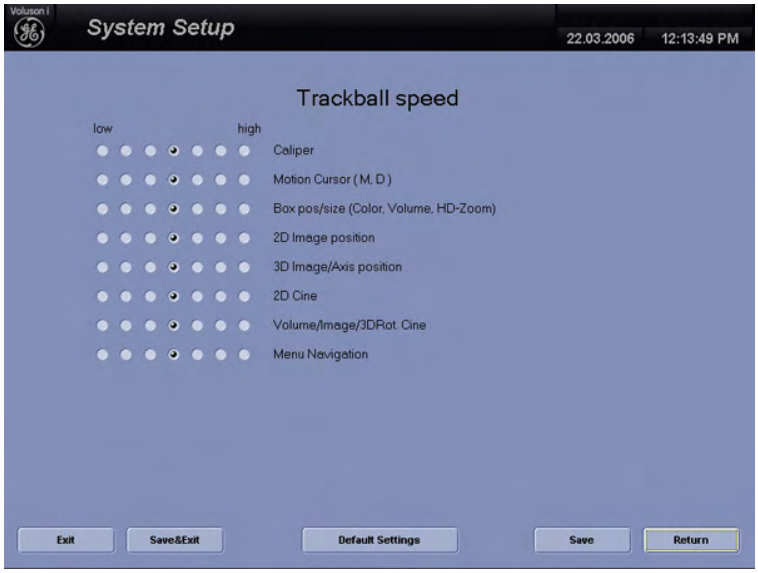
Note *[Save&Exit] button must be selected before exiting “Text Auto” or changes will be lost.*

16.3.4 To Adjust the Trackball Speed



1. Select the [Trackball speed] button (in the System Setup – **User Settings** page).

The “Trackball Speed” menu appears on the monitor.



2. Adjust the desired Trackball Speed for each function (low ´ high) using the trackball and the right or left trackball key [Set].

3. Select [Save] or [Save&Exit]. The trackball speed settings are saved in the database.

Exit: Back to the last active menu without saving.

Save: To save the current Trackball Speed settings.

Return: Back to the User Setting main menu.

Default Settings: A change of the default setting is protected by a password. The User cannot change the “Default Settings”.

16.4 P1-P2-P3

For information about configuration of the programmable keys see 'Programmable keys' *on page 15-2*.

16.5 Options

This page shows all available system options and their state.

D	Demo	Option is activated for demo and expires on the date shown in the “Valid” column.
I	Inactive	Option is not activated.
P	Permanent	Option is permanently activated (purchased).

Note *This sentence appears only, if the demo options are activated for 3 month.*

Serial Number: Shows the serial number of the System.

Demo Key: This field is used to enter and show the demo key (all options are available for a certain period of time) from OKOS.

Permanent Key: This field is used to enter and show encoding key for permanent available options.

Operation for installing a “Demo Key” or a “Permanent Key”:

1. Position the cursor inside the input field desired and press the left/right trackball key [Set].
2. If one exists, clear/edit the current key code.
3. Enter the encrypted serial code with the keyboard and then click on [Submit]. (The code will be checked.)
4. Click the [Save&Exit] button.

Remarks:

- After activating a key code, restart the system (turn off and on the system).
- To Exit from the System Setup without saving, select the [Exit] button.

Operation for activating “3 Month Demo”:

Note *Confirm that the Date & Time are selected correctly. You must not change the Date or Time after activating all the options. To prevent fraudulent use, this feature will be blocked. To Enter Date, Time and Time Zone review:* 'To Enter Date, Time and Time Zone' *on page 16-5.*



1. Click the [Activate] button to unlock all the Options over a limited period of 3 months.

The following window appears on the screen.



2. Click the [Now] button to activate all options.

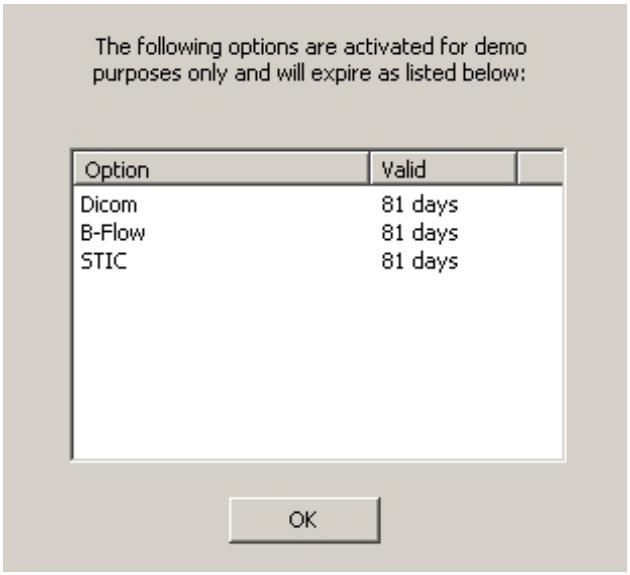
After activating, the Demo field in the “Options” window indicates the expiration date of the Demo.



3. To Exit from the System Setup click the [Save&Exit] or the [Exit] button.

Note *After activating the Demo options, restart the system (turn off and on the system).*

Following window appears during starting the application if demo options are active:

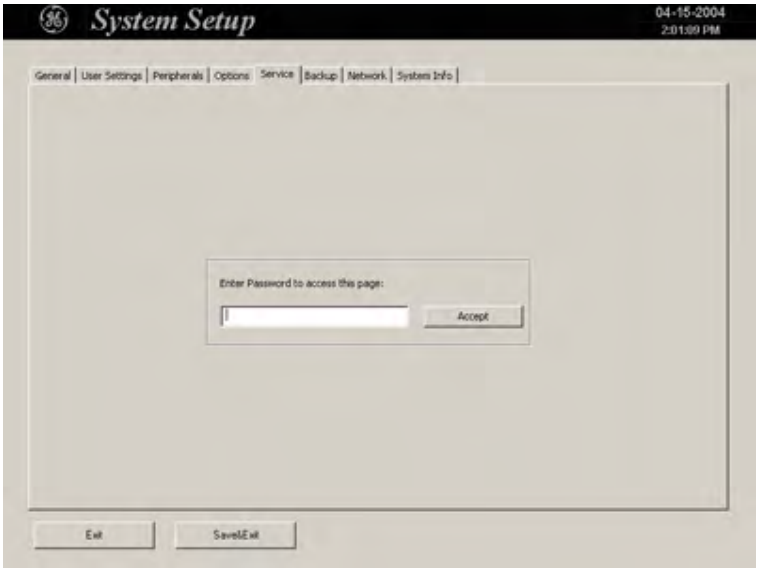


The window shows all demo options and the time they are valid.

The “3 Month Demo” options can only be activated once. The user **cannot** repeat this activation. To order a permanent option, or to get a Demo Key (from OKOS), please contact your local sales representative.

16.6 Service

1. Position the cursor into the displayed “password window” and press [Set].
2. Enter the password *** and click the [Accept] button to display the Service Tools window.



Note *For further details and explanations refer to the Service Manual of the system.*

16.7 Backup

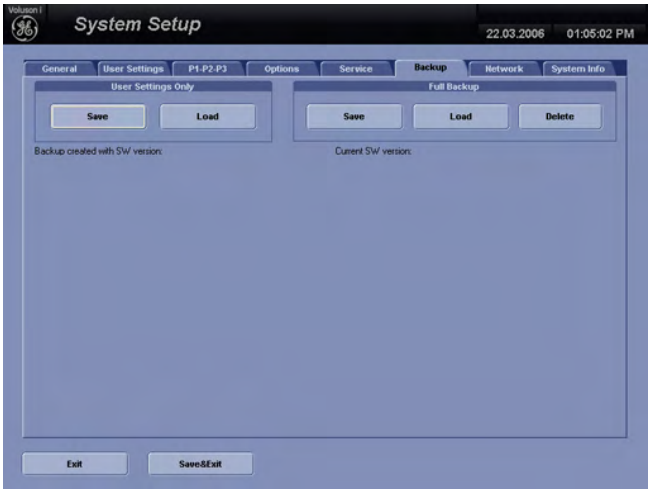
The “Backup” page is subdivided in two main groups:

User Settings Only

Save User Settings Only 'Save User Settings Only' *on page 16-17* Load User Settings Only 'Load User Settings Only' *on page 16-18*

Full Backup

Save Full Backup 'Save Full Backup' *on page 16-20* Load Full Backup 'Load Full Backup' *on page 16-22* Delete Full Backup 'Delete Full Backup' *on page 16-23*



The User Settings and/or Full Backup can be saved to the following destinations:

- D partition of internal hard disk
- DVD/CD+(R)W
- Mapped Network Drive **Z** review: Map Network Drive 'Map Network Drive' *on page 16-37*
- Any other drive connected to the system (e.g.; an external USB-hard disk) **Note:** This function is only available in the Full Backup utility. review: Working with external USB-Devices 'Delete Full Backup' *on page 16-23*

Do not disconnect an external USB-device without stopping it. Disconnecting without stopping can lead to data loss on the external device.

16.7.1 Save User Settings Only

With this function the internal database is saved to the selected read/write device.

The User Settings contain:

- User settings
- Auto Text
- Setup settings (language, date format, screensaver on/off, etc.)

1. Click on the [Save] button of the “User Settings Only” group in the System Setup - **Backup** page. The Load/Save window is displayed.



2. Choose the media (e.g., DVD/CD+(R)W) and click the [Save] button.

3. Select the [New File...] button and enter the backup name (file name).

4. Click [Ok]. The save procedure begins.

Cancel: Exit without saving.

16.7.2 Load User Settings Only

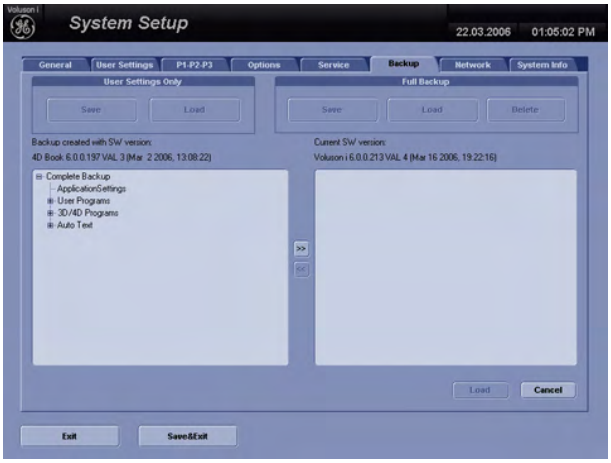
With the Load function the entire User Settings or parts of it can be loaded into the database to overwrite, restore, copy, etc... the database into the system.

1. Click on the [Load] button of the “User Settings Only” group in the System Setup - **Backup** page. The Load/Save window is displayed.



2. Choose the media (e.g., DVD/CD+(R)W) and click the [Load] button.

3. Select the appropriate file and click [OK]. The Load option window appears.



4. Select the appropriate “Backup Data”.

Complete Backup:



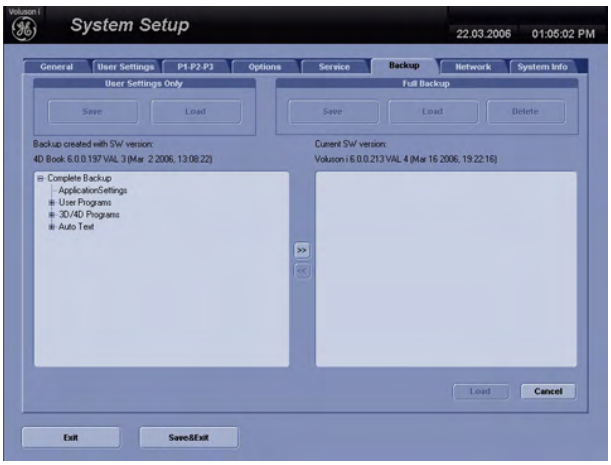
Select the Complete Backup and click the [>>] button to copy the Complete Backup into the Load Data field.



Click this button to start the loading procedure of the complete Backup into the system.

Note *Also only parts of a Backup can be loaded into database to overwrite, restore, copy etc... the database into the system.*

Click the plus **[+]** sign to open the content tree.



User Programs:

Select the appropriate group (all probes, probe & all applications, etc..) down to the final single program within the displayed tree. Click the [Arrow] button to copy the selected item into the Load Data field. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

Auto Text:

Select the Auto Text group. Click the [Arrow] to copy the selected item into the Load Data field. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

3D/4D Programs:

Select the appropriate group (all probes, probe & all applications etc..) down to the final single program within the displayed tree. Click the [Arrow] button to copy the selected item into the Load Data field. Click the [Load] button. The load procedure starts to load the selected item of Backup into the system.

Note 

To return selected items from the Load Data field to the Backup Data field select the [<<] button or click [Cancel].

16.7.3 Save Full Backup

A full backup always contains the following data:

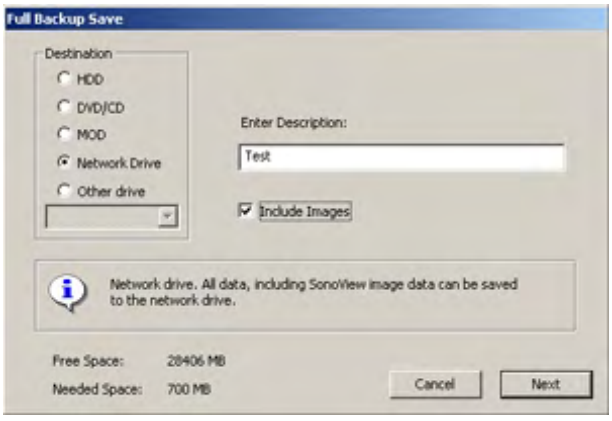
- Patient demographic and exam data (database containing the patient data and measurements, but no images)
- SonoView image data (**NOT** available when saving to the internal hard disk, DVD/CD)
- User Settings (databases and files containing gray curves and the user settings.)
- Image transfer settings (DICOM settings e.g., DICOM servers, AE Title, Station Name, etc.)
- Measure Setup Settings (user specific measure settings)
- Machine settings (general settings such as language, time/date format and the enabled options)
- Windows Network Settings (network settings including the computer name)
- Remote service platform (state of the serviceplatform *InSite2*)



All settings and patient data created since last full backup are **NOT** backed-up! It is highly recommended to create a full backup of settings and patient data regularly.

Saving procedure:

1. Click on the [Save] button of the “Full Backup” group in the System Setup - **Backup** page. The Full Backup Save window is displayed.



2. Choose the destination (e.g., Network Drive).

3. Enter description of the full backup.

4. If desired and possible, activate “Include Images” (check mark visible). **NOTE:** This can be a large amount of data, up to **70** gigabytes!



5. Select the [Next] button to start the backup process.

After copying the data, the system reboots and the application starts again.

Cancel: Exit without saving.

Remarks:

- It is possible to store more than one backup on a destination. The backups reside in subfolders of the main “*fullbackup*”-folder found at the root of the drive (e.g., z:\fullbackup). **DO NOT** modify this directory structure or any files within, otherwise the backup data cannot be restored. For further details review: Note for the Administration of “Full Backup” Data 'Note for the Administration of “Full Backup” Data' *on page 2-11*.
- The “Include Images” checkbox is **only** active, if destination “Network Drive” or “Other drive” is selected.



- If the destination „Other drive“ is selected, the available drives (e.g., external USB-memory stick) can be chosen from the drop down list.

Note *When the backup is saved to an external USB-device, the system has to be informed about the removal of the hardware. For this purpose every last dialog of Full Backup has a [Stop USB Devices] button. Review: Working with external USB-Devices in* 'Delete Full Backup' *on page 16-23*

16.7.4 Load Full Backup

There are circumstances where it is not possible to load (restore) all the data. The following rules specify the restrictions:

1. Generally, **only** restoring data from an older to a newer software version is possible. Loading a backup into a system that has a lower software version than the system the backup was created on is prohibited.
2. Options can **only** be restored on the same Voluson® i resp. Pro V system within the same major software version.
3. When loading a backup into a system with a software version that has a higher major number (2.x.x -> 3.x.x), the following items will not be restored:

User Settings

Options



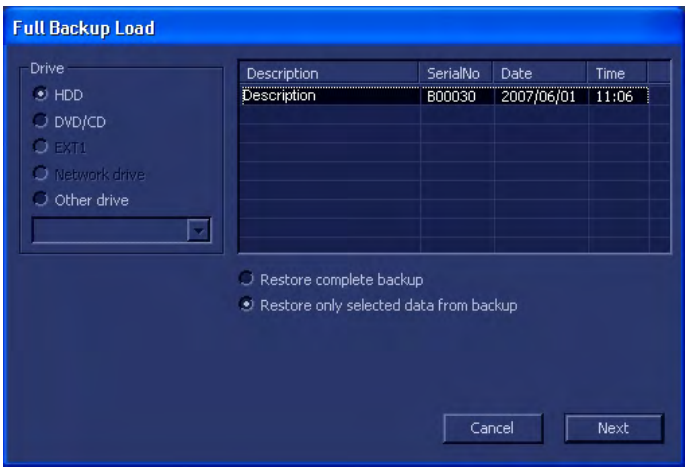
State of the Serviceplatform (new model type necessary for VOLC)

1. The **user** is **only** allowed to restore data to a different system if and only if the software version on this system is the same as in the backup.
2. The **user** is **only** allowed to restore data onto the same system if and only if the software version on this system is equal or higher than the version in the backup.
3. The **user** is **not** allowed to restore the following items to a different system:

- Windows Network Settings
- Options
- DICOM AE Title
- DICOM Station Name
- State of the service platform.

Loading procedure:

1. To restore a previously saved backup, click on the [Load] button of the “Full Backup” group in the System Setup - **Backup** page. The Full Backup Load window is displayed.

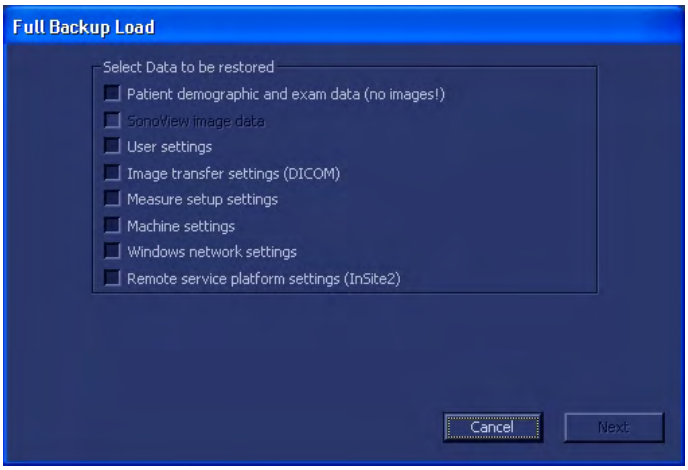


2. Choose the destination (e.g., Network Drive).

3. Click on the backup to be restored (additional information is displayed in the table).



4. Select the [Next] button. The following window will be displayed.



5. Select the data to be restored to the Voluson® i. For description of the checkbox names review: Save Full Backup 'Save Full Backup' *on page 16-20*.

The data from the backup always replaces the corresponding data on the Voluson® i.

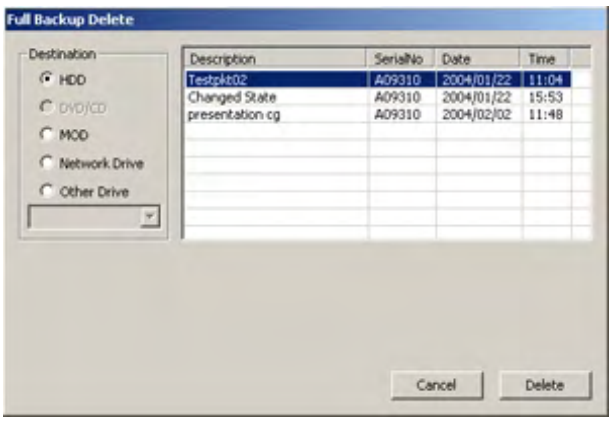


6. Select the [Next] button again to start the restore process.

After copying the data, the system reboots and the application starts again.

16.7.5 Delete Full Backup

1. To delete an existing backup, click on the [Delete] button of the “Full Backup” group in the System Setup - **Backup** page. The Full Backup Delete window is displayed.



2. Choose the destination (e.g., HDD).

3. Click on the backup to be deleted (additional information is displayed in the table).



4. Select the [Delete] button.

There is no “undo” function for this action!

16.7.5.1 Working with external USB-Devices

When an external USB-storage device is connected to the system, such as a memory stick or a hard disk, Windows detects the device and automatically installs a driver. .

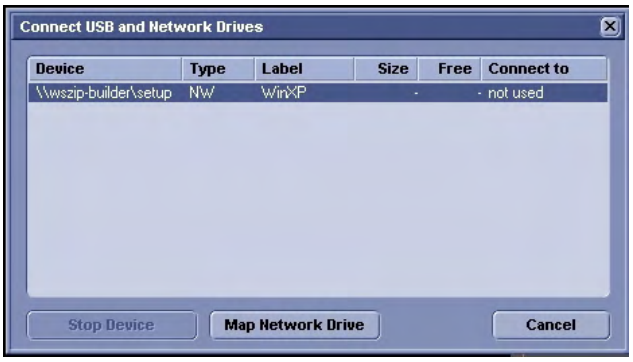
Before an external USB-device (e.g., USB-memory stick) can be disconnected, the system has to be informed about the removal of the device! For this purpose every last dialog of “Full Backup Save” and “Full Backup Delete” has a [Stop USB Devices] button.



Note *The [Stop USB Devices] button can also be found in the System Setup - **Backup** page.*

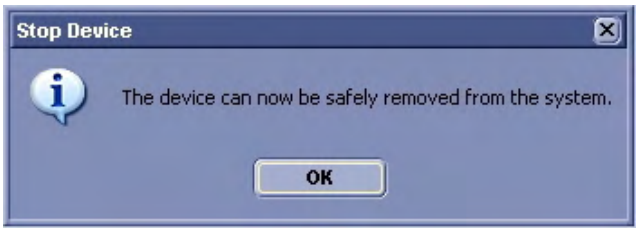
By pressing the [Stop USB Devices] button, the „Unplug or Eject Hardware“ dialog is started. Using this dialog, the USB-devices can be stopped before they are physically disconnected.





The „Unplug or Eject Hardware“ dialog shows all USB-devices that are connected to the system. On every system is an USB mass storage device, the DVD/CD writer, which has the drive letter **(CD/DVD Recorder:)**. If the system has an optional MO-drive installed as well, it is listed too, and has the drive letter **(Ext1:)**.

To stop the external device, select it and press the [Stop] button. Then a dialog shows which components will be stopped. To finish the process, click [OK].



Finally, a dialog shows that the device was stopped successfully. The device can now be safely disconnected from the system.

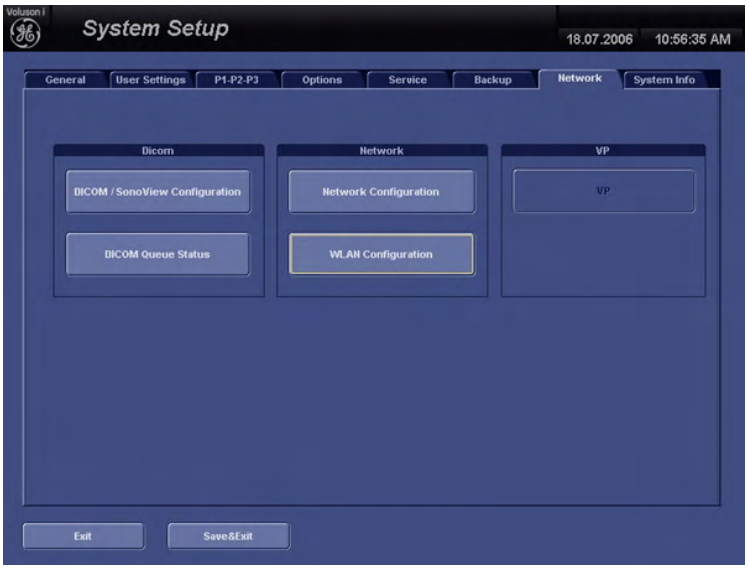
By clicking [OK], the „Unplug or Eject Hardware“ dialog is active again. Close this dialog by clicking [Close]. Afterwards select [OK] to reboot the system.

Do not connect or disconnect any external USB-devices to or from the system while scanning a patient! The appearing dialogs could distract you from the scan!

Do not disconnect an external USB-device without stopping it as described above. Disconnecting without stopping can lead to data loss on the external device.

If the system’s (optional) DVD/CD writer was stopped by accident, simply stop the external device as well and reboot the system. During reboot, the DVD/CD writer will be installed again.

16.8 Network



For detailed description review:

DICOM Configuration 'DICOM Configuration' *on page 16-26*

To Specify a DICOM Address 'To Specify a DICOM Address' *on page 16-27*

SonoView Configuration 'SonoView Configuration' *on page 16-30*

DICOM Queue Status 'DICOM Queue Status' *on page 16-32*

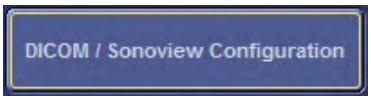
Network Configuration 'Network Configuration' *on page 16-33*

Map Network Drive 'Map Network Drive' *on page 16-37*

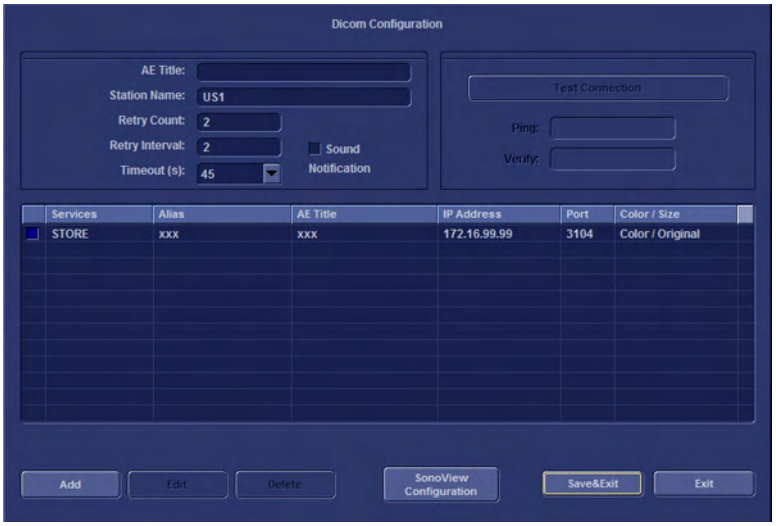
16.8.1 DICOM Configuration

DICOM is the abbreviation of Digital Imaging and Communications in Medicine. This is the industrial standard for communication of images and other information between medical devices on the network. Using the DICOM option, you can send or print images after connecting your ultrasound equipment and PACS.

This dialog section is used to set up details of all of your DICOM target nodes (image servers). Once you have set up a DICOM node properly, data can simply be transmitted by selecting the appropriate target node.



Select the [DICOM / SonoView Configuration] button (in the System Setup - **Network** page) to display the DICOM Configuration window.



AE (**A**pplication **E**ntity) **Title:**

Please enter the Application Entity Title under which your DICOM-application is known to other DICOM applications (required). For setting the correct AE-Title please contact your DICOM network administrator. e.g., Voluson® i.

Station Name:

Please enter the name of the hospital or institute.

Retry Count:

Number of retries to establish a non-successful DICOM connection.

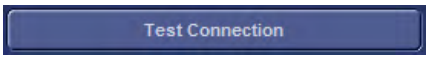
Retry Interval:

Time pause in minutes between two attempts to establish a non-successful DICOM connection.

Test Connection:

Test the connection to a DICOM station. (This test may take up to 30 seconds).

First select the station to test with the right or left trackball key, then click the [Test Connection] button. If the TCP/IP connection to the remote station is active, "OK" will appear in the [Ping] line. If the DICOM server on the remote station is active, "OK" will appear in the [Verify] line.



Note *This button appears only if Service [Report] and Transfer via serial port is selected.*

16.8.2 To Specify a DICOM Address



Select the [DICOM / SonoView Configuration] button (in the System Setup - **Network** page) to display the DICOM Configuration window.

Add: To add a new DICOM node click on the [Add] button.

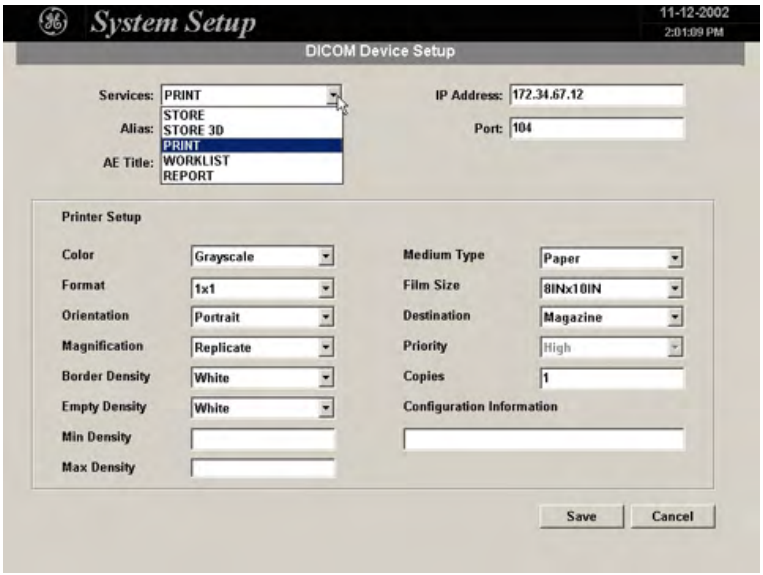
Edit: To edit or view data of a DICOM node, select one and click the [Edit] button.

Delete: To delete a DICOM node, select one and click the [Delete] button.

After clicking the [Add] or [Edit] button the “DICOM Device Setup” window appears. (e.g., PRINT)

Remarks:

- It is possible to add more than one [STORE] , [STORE 3D] , [PRINT], [MPPS], [WORKLIST], [STRUCTURED REPORTING] and [STORAGE COMMIT] destination. However, only one [PRINT], [STRUCTURED REPORTING], [MPPS] and [WORKLIST] destination can be selected at a time.
- If more than one [STORE], [STORE 3D] or [STORAGE COMMIT] services are selected, images are sent to all selected STORE or STORE3D destinations and committed with all STORAGE COMMIT destinations.
- It is possible to use different Port numbers for each item in the “Services” list.



To specify a DICOM address define the following fields:

Services: Select [STORE] to send screen images, 2D cine sequences and 3D/4D data to a DICOM server (e.g., Radworks Server).

Select [STORE 3D] to send **3D/4D data only** (volumes and cine sequences) to a different store server (e.g., PC with Software 4D View installed) than screen images and 2D cine sequences.

Select [PRINT] to send images stored in printer clipboard to a DICOM printer.

Select [MPPS] to send images to a DICOM server with transfer information.

Select [ST. COMMIT] to send image with an additional layer of security.

Select [STR. REPORT] to send a structured report.

Select [REPORT] to send the Patient report data to a PC via network or serial port.

Select [WORKLIST] to retrieve Patient Information (Name, ID, Birth,...) from an external Worklist server (e.g., HIS - Hospital Information System / RIS).

AE-Title: **A**pplication **E**ntity Title of the remote DICOM application.

Alias: Enter a nickname for each DICOM node to make it easier to handle various nodes. Use any name, but do not insert space characters.

IP-Address: Enter the hostname or IP-address of the DICOM node. e.g., any.dicom.server.net

Port Number: Enter the port number of the DICOM node. (e.g., 104)

16.8.2.1 STORE / STORE 3D



Color

select either Color, Grayscale or Automatic

Image Size

select either Original or 640x480

2D Compression

select either NONE or JPEG

2D JPEG Quality

select the desired JPEG-compression factor

Cine Compression

select either NONE or JPEG

Cine JPEG Quality

select the desired JPEG-compression factor

Volume Compr.

Select None, lossless or wavelet lossy

Volume Wavelet Quality

Select 85, 90 or 95

DICOM Image Type

select either Default[1] or Secondary capture[2]

Send 2D Cine as

Multiframe

Send 3D Rotation Cine as

select either Voluson Format[*] or Multiframe[**]

Send 4D Image Cine as

select either Voluson Format[*] or Multiframe[**]

Send 4D Volume Cine as

Voluson Format



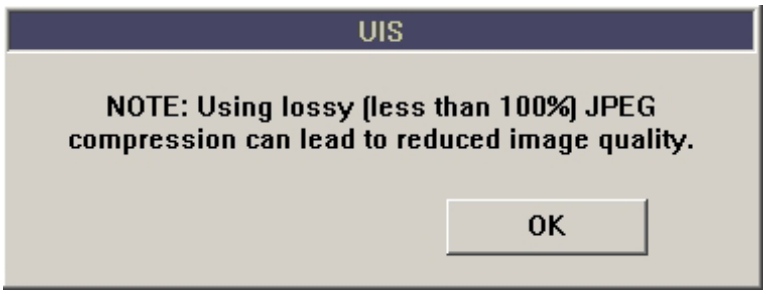
Sets the entire **STORE / STORE 3D** settings to their predefined values which are optimal for transmitting to PC with software “4D View”.



Sets the entire **STORE / STORE 3D** settings to their predefined values which are optimal for transmitting to other DICOM stations.



Sets the entire **STORE / STORE 3D** settings to their predefined values which are optimal for transmitting to a ViewPoint system.



Ultrasound images are consuming a lot of the system’s memory resources. Therefore, the JPEG-compression method can be applied to the images to reduce their size. When selecting the JPEG-compression less than 100% a message appears.

1	Default	single frame images will be sent as normal US DICOM files; screen captures (e.g., Patient ID report) will be sent as secondary capture
2	second. capture	all single frame images and screen captures will be sent as secondary capture
*	Voluson Format	is an internal format that provides full functionality upon reloading into the PC software “4D View”.
**	Multiframe	is a DICOM compatible format which allows 2D Cine review on most DICOM platforms.

16.8.2.2 PRINT

By selecting Service [PRINT] the Printer Setup fields are available to adjust the printer configuration.

16.8.2.3 MPPS

The following settings can be adjusted:

Store Server Select a STORE / STORE 3D server from the dropdown field.

SR Server Select a STR. REPORT server from the dropdown field.

16.8.2.4 ST.COMMIT

No special settings.

16.8.2.5 STR.REPORT

The following settings can be adjusted:

Combine OB & GYN Check this item to send structured reporting data from appllications OB and GYN in a single file.

ST.COMMIT Select a Storage Commitment Server from the dropdown field.

16.8.2.6 WORKLIST



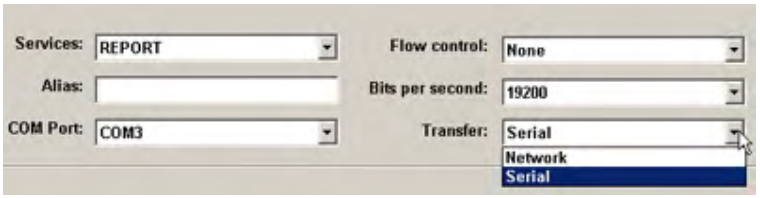
With a [WORKLIST] service a filter (mask) can be selected especially for patient data marked with ***Modality*** "Ultrasound". Enable ***Private Tags*** for communication with a ViewPoint system. The ***Add local data*** option determines if data from a worklist server should be merged with locally stored patient data. Set this option to ***Yes*** to allow merging of worklist data or to ***No*** to discard worklist data. The ***Ask*** setting causes a dialog box to pop up whenever patient data from a worklist server is going to be merged with locally stored data.

16.8.2.7 REPORT

By selecting Service [REPORT] you can choose between two Transfer Modes:

- Network - to send the Patient report to a PC report station via DICOM network
- Serial - to send the Patient report to a PC report station that is connected by serial port. The optional "**PRY** USB-RS232 Connection kit" must be connected to the system.

If you select "Serial" different field are available to adjust the report transfer configuration:



Only one address for a [REPORT] station can be configured (any AE-Title can be used). The sent report data are compatible with "View Point"!

Note *The baud rate (bits per second) must be the same as on the receiving PC report station.*

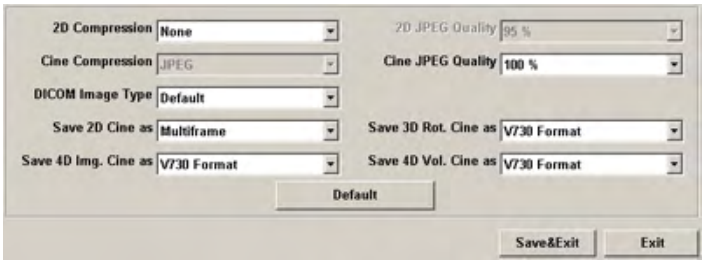
16.8.3 SonoView Configuration



Select the [DICOM / SonoView Configuration] button (in the System Setup - **Network** page) to display the DICOM Configuration window.



Select the [SonoView Options] button to display the following window.



2D Compressionselect either NONE or JPEG

2D JPEG Qualityselect the desired JPEG-compression factor

Cine CompressionJPEG

Cine JPEG Qualityselect the desired JPEG-compression factor

Volume Compr.

Select None, lossless or wavelet lossy

Volume Wavelet Quality

Select 85, 90 or 95

DICOM Image Typeselect either Default[1] or Secondary capture[2]

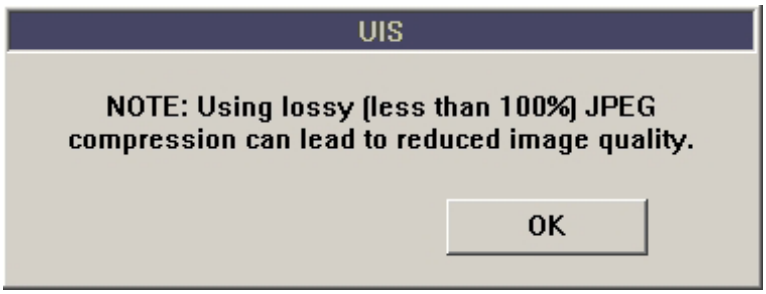
Save 2D Cine as Multiframe

Save 3D Rotation Cine asselect either Voluson Format[*] or Multiframe[**]

Save 4D Image Cine asselect either Voluson Format[*] or Multiframe[**]

Save 4D Volume Cine as VolusonFormat

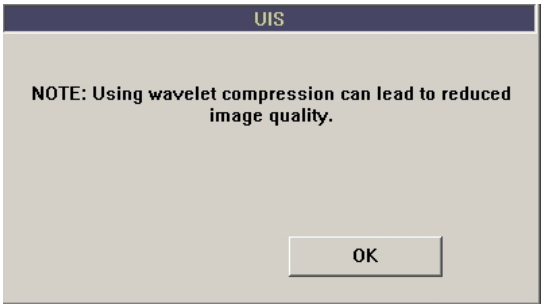
1	Default	single frame images will be sent as normal US DICOM files; screen captures (e.g., Patient ID report) will be sent as secondary capture
2	second. capture	all single frame images and screen captures will be sent as secondary capture
*	Voluson Format	is an internal format that provides full functionality upon reloading into the PC software “4D View”.
**	Multiframe	is a DICOM compatible format which allows 2D Cine review on most DICOM platforms.



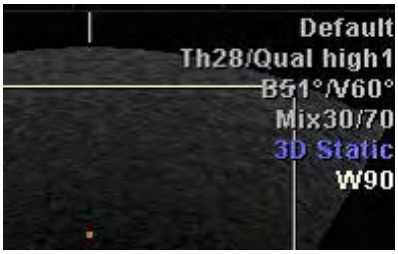
Ultrasound images are consuming a lot of the system’s memory resources. Therefore, the JPEG-compression method can be applied to the images to reduce their size. When selecting the JPEG-compression less than 100% a message appears.

Note *Volume Wavelet Quality is only enabled if Volume Compression is wavelet lossy.*

Whenever lossy compression is activated the following dialog appears:

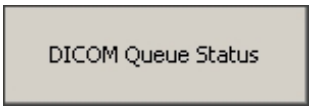


If the volume contains color information, the color part of the volume is compressed with a setting that is 5 points better than the selected setting, e.g. Setting 90 → color compression 95, grey compession 90



If a volume is compressed using lossy wavelet compression, a yellow sign (Wxx; xx = compression factor, e.g. W9) is added when reloading the image.

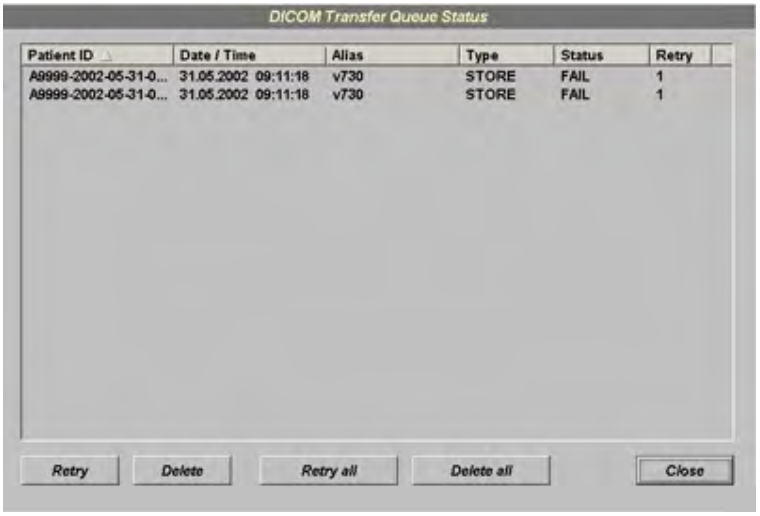
16.8.4 DICOM Queue Status



Select the [DICOM Queue Status] button (in the System Setup - **Network** page) to display the DICOM Transfer Queue Status window.

The “Queue Status” window displays all DICOM transfers, which have not been sent, which are being

sent at the moment or which failed. (Successful transfers are deleted from the list).



Note *If the transfer was successful, but a storage commitment request was not yet successful, the images receive the status "sent". As soon as the storage commitment was successful the entries (both images and storage commit) are deleted from the list.*



Select the [Retry] button to retry selected exam.



Select the [Retry all] button to retry all exams.



Select the [Delete] button to delete selected exam.

Select the [Delete all] button to delete all exams.



Select the [Hold Queue] button.

Note *If the [Hold Queue] button is selected, the system no longer tries to send the data in the queue (e.g. when the system is removed from the network).*

The "Queue Status" window appears.





As soon as the [Process Queue] button is selected, the system continues to send the data.



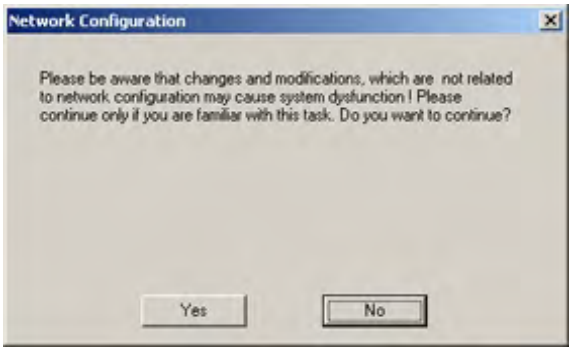
Select the [Close] button to close the DICOM Transfer Queue Status window.

16.8.5 Network Configuration



Select the [Network Configuration] button (in the System Setup - **Network** page) to perform Network IP Address Configuration.

Before configuring the "Internet Protocol (TCP/IP) Properties", the following message appears:

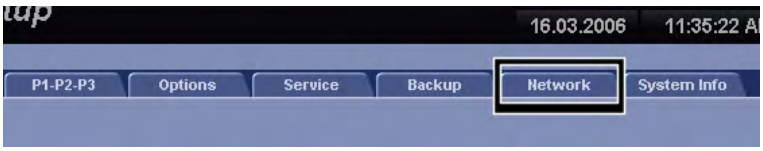

Network Configuration
Please be aware that changes and modifications, which are not related to network configuration may cause system dysfunction ! Please continue only if you are familiar with this task. Do you want to continue?
Yes
No

16.8.6 Wireless LAN configuration

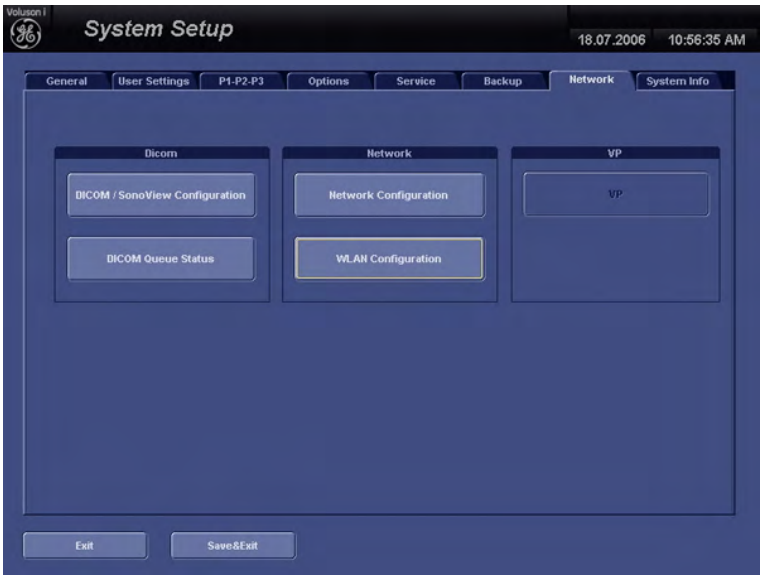
The WLAN security has to be adjusted to prevent viruses and to ensure data protection. See you local System-Administrator to adjust the WLAN security.

The WLAN adjustements and hardware may differ in some countries. Please check the requirements or talk to your local Online Center

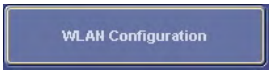
To connect the wireless LAN USB stick to the Voluson® i, 'Hardware options' *on page 19-4*



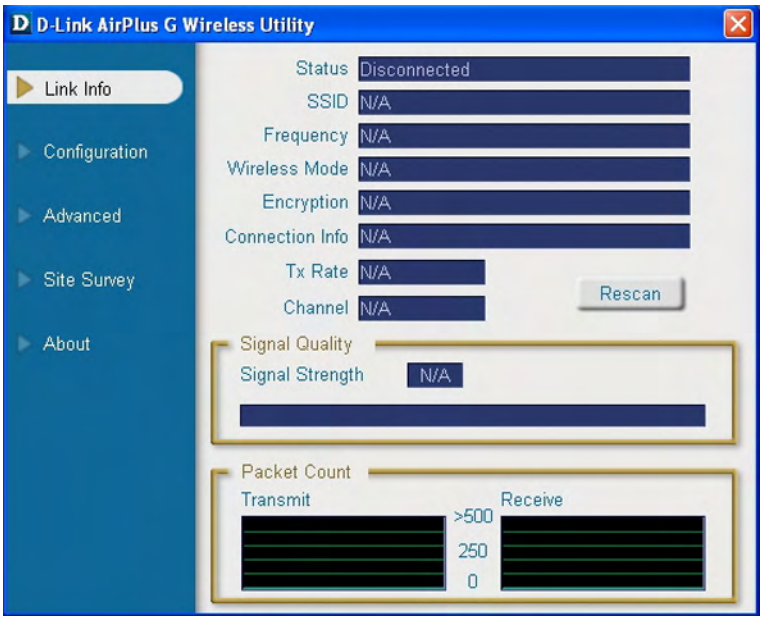
In the System Setup select the [Network] part.



Press the [WLAN Configuration] button to enter the wireless LAN menu.



The Wireless Utility appears on the screen.



The configuration process will start automatically, and after a few seconds waiting, the field “Connection Info” on screen should say “connected” and the other values should have been entered automatically. If not ask your local system administrator for help.

Check LAN Status see: 'Screen symbols and Battery status' *on page 3-5*

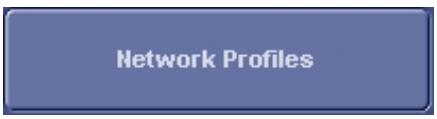
16.8.7 Network profiles

16.8.7.1 Introduction

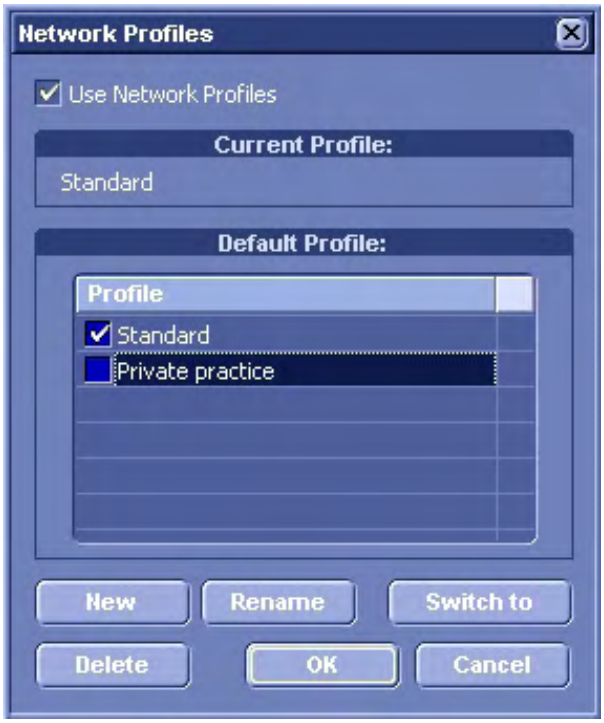
Define and switch between different network settings for all your work environments to further improve Voluson® i’s portability. The following settings are stored in a network profile:

- All DICOM settings and configurations
- Static IP address, gateway, network mask, DNS
- Printer settings
- Button configuration
- Hospital name
- Network-Drive mappings

16.8.7.2 Network profiles dialog



Click the ***Network Profiles*** button in the network tab of the system setup. The following dialog box appears:



To start using network profiles, set the ***Use Network Profiles*** option in the upper section of the dialog. The currenty used profile is displayed in the ***Current Profile*** textbox.

In the ***Defaul Profile*** section click the checkbox next to the profile name which should be active from boot-up. If no default is set, the system requests the desired network profile everytime after boot-up.

Click the ***New*** button to set up a new profile. *For more information see* 'How to set up network profiles' *on page 16-37.*

Click the ***Rename*** button to rename the highlighted network profile.

Click ***Switch to*** to change the currently active network settings to the ones stored in the highlighted network profile.

Click ***Delete*** to delete the highlighted network profile.

Click ***OK*** to confirm changes or ***Cancel*** to abort the operation.

16.8.7.3 How to set up network profiles

After clicking the ***New*** button the following dialog appears:



Specify a name for the network profile in the ***Profile Name*** textfield. There are to options to ***Copy Settings from:***

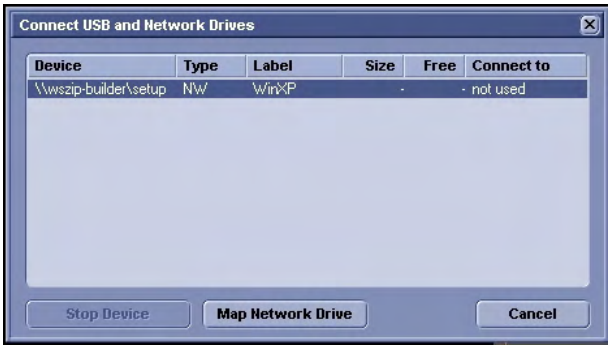
- ***Current Settings*** The current network setup of the system is stored in the network profile.
- The dropdown field lists all stored network profiles. Choose this option and the desired source profile to copy the settings to the new profile.

Click ***OK*** to save the network profile or press ***Cancel*** to abort the operation.

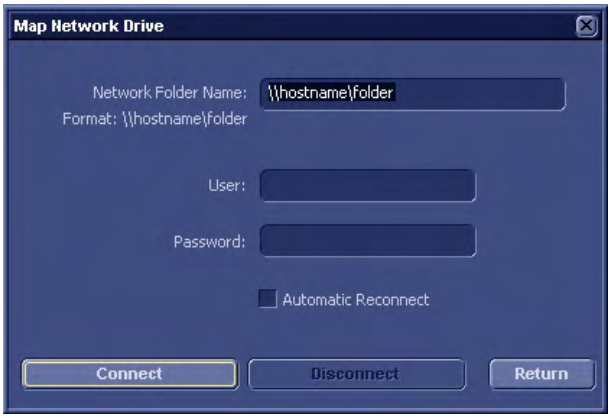
16.8.8 Map Network Drive



Press the [USB] Hardkey.



Select the [Map Network Drive] button (in the System Setup - **Network** page) to open a dialog where the system can be connected to a shared network drive of another server.



1. Enter the name of the shared network folder in the „Network Folder Name“ field.

Note *The **Danish** keyboard layout on the Voluson® i does not include a “/” (slash) key. Please resort to the slash characters in the text field to enter a network path. To copy a character, highlight it with the text cursor and press **Ctrl + C** and **Ctrl + V**.*

2. Supply a valid username and a password for this folder.

Note *If you check the „Automatic Reconnect“ box, the system tries to establish the connection again when starting up. Otherwise, the connection must be re-established manually after a shutdown or reboot.*

3. Select the [Connect] button to establish the connection to the remote machine. If successful, the [Disconnect] button becomes active.

Remarks:

- If there is an error during the connection, a warning message appears inside the dialog. In this case, please verify the data in the dialog.
- If there already is a connection to the remote server, the [Connect] button is grayed. To change the existing connection, first click on [Disconnect] and enter the new settings.



Please make sure that the server you are connecting to is trustworthy and reliable. For details, contact your local system administrator. If you backup SonoView data to this server, all the patients’ demographic data will be copied to this server!

16.9 System Info

In the “System Info” page the Software/Hardware version that is installed in the system can be seen.



Serial Number: Displays the serial number of the system.

System Info Software: Display of the current software version of the system.

System Info Hardware: Display of the current hardware version of the system.

Patent Applications: Opens an additional window, showing all applications/patents the Voluson® i system is protected with.

Move the scroll bar downwards to review additional information about installed software.

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Chapter 17

Measure Setup / Biopsy Setup

Describes the funktions of the Biopsy -and Measure Setup.

Measure Setup / Biopsy Setup

Introduction

Modifications of measurement parameters are done with support of diverse dialog pages and windows on the measurement setup desktop.

Generally operations are done with the trackball and the trackball keys (mouse emulation).



Trackball (mouse position): positions the pointing device (arrow) on the desktop



left trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device



upper trackball key (right mouse button): no function in system desktop



right trackball key (left mouse button): sets, fixates markers and activates pages/buttons etc. marked by the pointing device

Note *There is a National Language Support for the whole measurement package (generic and calculation measurements, Measurement setup and worksheets/reports). Supported languages are: English, German, French, Italian and Spanish. To change the language, review: General* 'General' *on page 16-4*

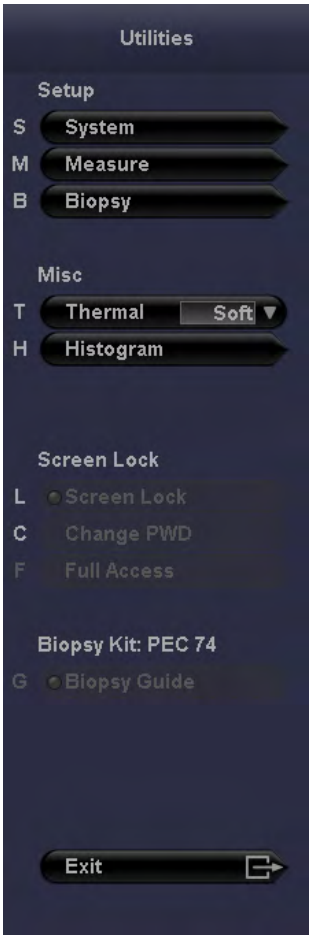
17.1 To Invoke the Setup Procedure

Select the [Measure] item in the menu "Utilities" to activate the Setup desktop on the screen.



1. Press the **[Utilities]** key on the control panel.

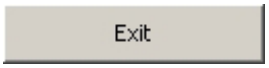
The menu area changes to the Utilities menu.



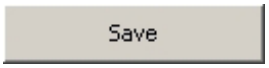


2. Select the [Measure] item.

17.2 To Exit from Measure Setup



Select the [Exit] button on the screen; touch the [Exit] key on the touchpanel, or press **[Exit]** on the control panel. Setup changes are cancelled and not saved.



Select the [Save] button with the mouse pointer (arrow) and press [Set] (right trackball key) to save the settings and exit the Measure Setup.

17.3 The Measure Setup Pages

The Measure Setup desktop offers different pages:

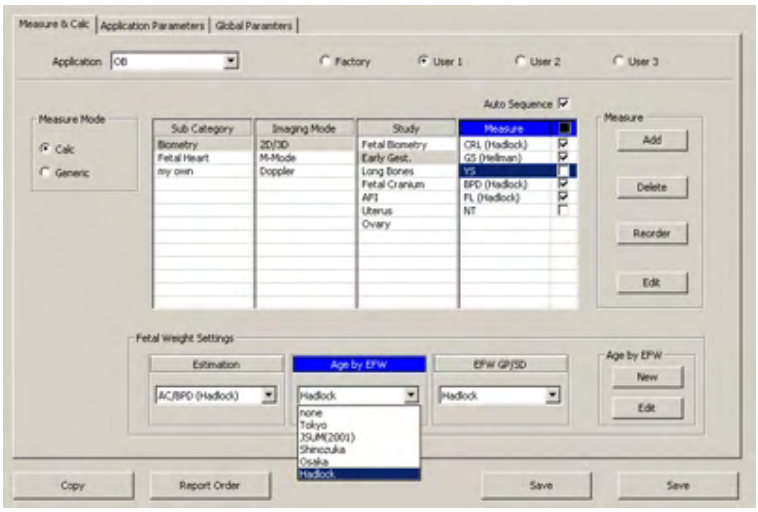
- Measure & Calc 'Measure & Calc' *on page 17-4)*

- Application Parameters 'Application Parameters' *on page 17-17)*
- Global Parameters 'Global Parameters' *on page 17-19*

17.3.1 Measure & Calc

This page shows all settings, which are used for generic measurements (for details review, *Chapter 12* as well as calculations (for details review, *Chapter 13* in different applications.)

Application: e.g., **Obstetric**



Parameters and possible adjustments depend on the selected Application. To view, add, delete, reorder, edit, or when creating a new parameter, it is very important that all items are chosen correctly, and that the relevant item is highlighted.

For Example: (image above)

1. Application 2. Measure Preset 3. Measure Mode 4. Sub Category 5. Imaging Mode 6. Study 7. Measure

OB (Obstetric) User 1 Calc Biometry 2D/3D Early Gestation **YS** (is the highlighted, relevant item)

Application:	Select the desired Application (e.g., Obstetric).
Setting:	Select a measure setting (e.g., User 1). The terms can be renamed; review: Application Parameters 'Application Parameters' *on page 17-17*.
Measure Mode:	Select the Measure Mode: Generic or Calc
Sub Category:	Shows the available sub measurement groups.
Imaging Mode:	Shows the available display modes. Adding, Deleting, Reordering or Editing an Imaging Mode is impossible!
Study:	Shows the available measurement methods.
Measure:	Shows the available measure items.

Auto Sequence: Measure Auto Sequence on/off If Auto Sequence is “On” (check mark visible), select the items that should be measured in an automatic sequence when pressing the **[Calc]** key. (Either select the parameters individual or set only one check mark directly into the “black” box to mark them all.)

Add — To Add a Sub Category, Study or Measure Item 'To Add a Sub Category, Study or Measure Item' *on page 17-5*

New — To Create a New Measurement or Calculation Item 'To Create a New Measurement or Calculation Item' *on page 17-7*

Delete — To Delete a Sub Category, Study or Measure Item 'To Delete a Sub Category, Study or Measure Item' *on page 17-10)*

Reorder — To Reorder a Sub Category, Study or Measure Item 'To Reorder a Sub Category, Study or Measure Item' *on page 17-11)*

Edit — To Edit a Sub Category, Study or Measure Item 'To Edit a Sub Category, Study or Measure Item' *on page 17-11)*

Fetal Weight Settings:

Estimation: Shows the current selection. Click on this field to create a New, or Edit the setting.

Age by EFW: Shows the current selection. Click on this field to create a New, or Edit the setting.

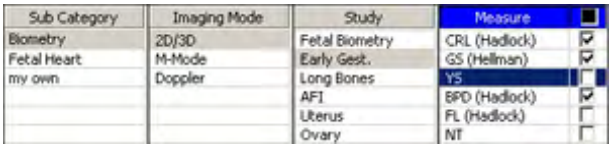
EFW GP/SD: Shows the current selection. Click on this field to create a New, or Edit the setting.

New — Create a new Fetal Weight setting.

Edit — Edit a Fetal Weight setting.

17.3.1.1 To Add a Sub Category, Study or Measure Item

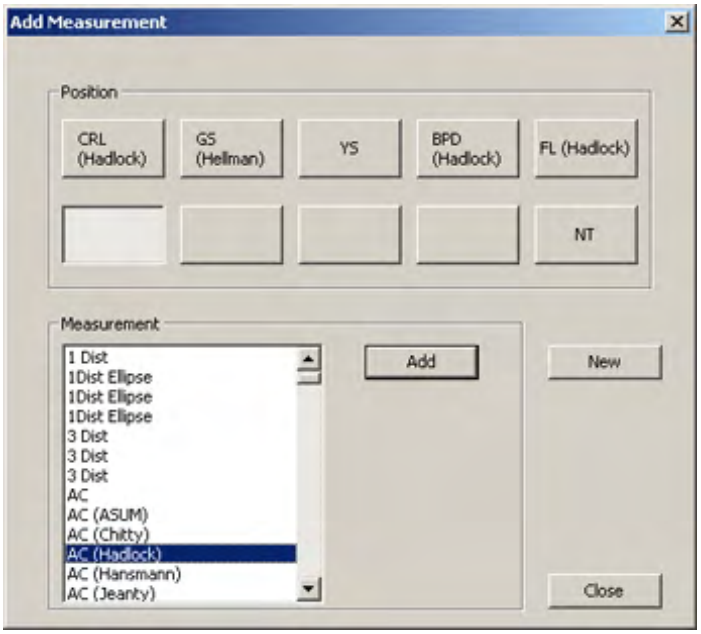
1. Select the relevant item in (all) the digest column(s) and then highlight the one where you want to add an entry. For example: Biometry - 2D/3D - Early Gest. - **Measure** (= column where you add an entry)



2. If necessary, mark an item in the selected digest column (e.g., YS).

Add

3. Select the [Add] button.



4. Select a position field. (It is also possible to replace an existing item.)



To add an existing preset, select the desired entry (marked blue) from the sub window and then click on the [Add] button and then click on [Close].



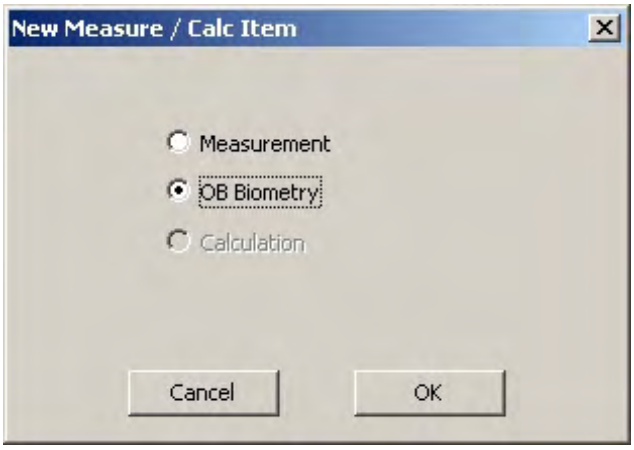
To create a new entry, click on the [New] button.

- When creating a new “Sub Category” or “Study” entry, following window appears:



Enter a name, confirm with [OK] and then click the [Close] button.

- When creating a new (user-defined) “Measure” item, following window appears:



a) Select the item desired and then click on [OK].

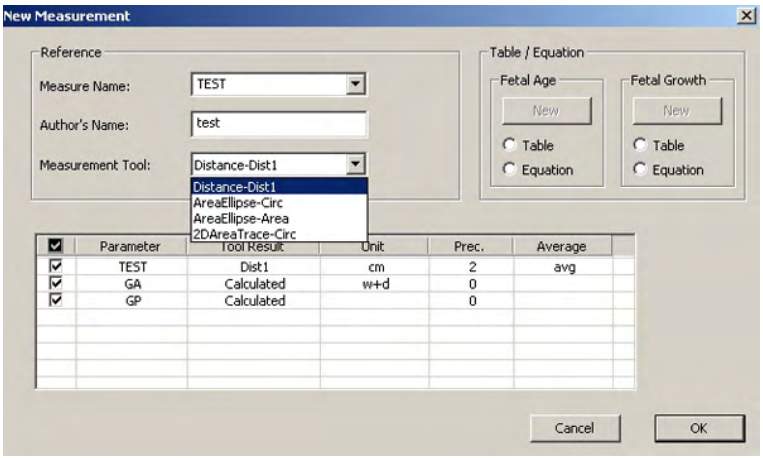
17.3.1.1.1 To Create a New Measurement or Calculation Item

1. Select the relevant item in (all) the digest column(s) and then highlight the **Measure** column. For further details, review: To Add a Sub Category, Study or Measure Item 'To Add a Sub Category, Study or Measure Item' *on page 17-5*



2. To create a new entry, click on the [New] button.

3. In the “New Measure / Calc Item” window, select the item desired and then click [OK].



4. In the displayed screen, select resp. enter:

Measure Name:	Either select a parameter from the drop down menu or enter it directly.
Author's Name:	Enter Author’s Name Author’s Name must be unique if measure Name exists!
Measurement Tool:	Select the measurement parameter from the drop down menu

“Selection Field”:	Adjust the display in the worksheet and the measure result field.	
	Parameter:	set check mark(s) individual or all (check mark in “black box)
	Tool Result:	shows parameters to measure and items that will be calculated
	Unit:	click into the line desired to change the unit
	Precision:	click into the line desired to change the precision (# after comma)
	Average:	click into the line desired to change the average display
Table / Equation:	Fetal Age:	select either Table or Equation and then click on [New]
	Fetal Growth:	select either Table or Equation and then click on [New]

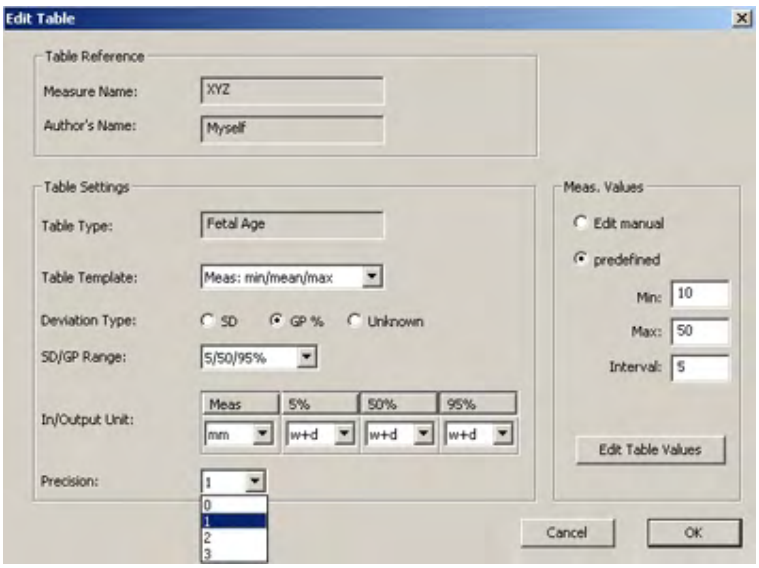
5. To confirm all settings, click on the [OK] button.



Fetal Age tables or equations are **NOT** the same as Fetal Growth tables or equations!

Fetal Age	These are normal ranges for **estimating an unknown gestational age** from the sonographically measured variable.
Fetal Growth	These are normal ranges for sonographically determined variables **as a function of gestational age**. Therefore, the last Menstruation Period (LMP) must be entered first, otherwise the Growth Curve [Graph] won’t be shown in the worklist.

1. New Table: (e.g., Fetal Age)

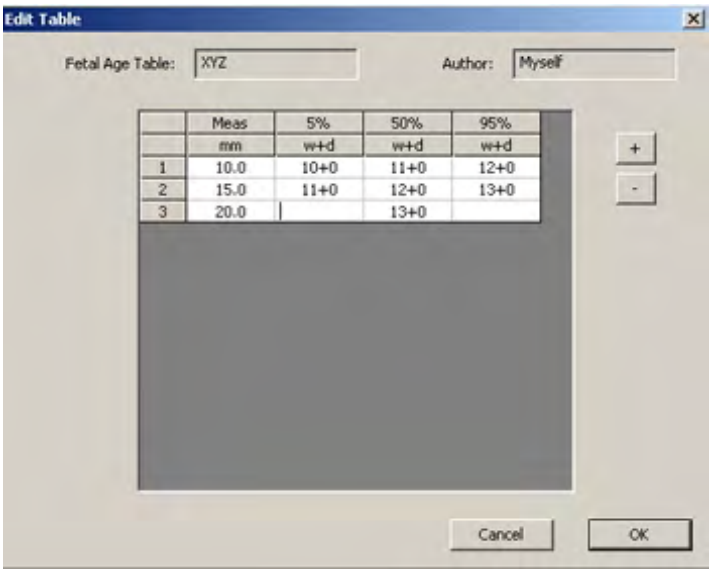


- In the displayed screen, select resp. enter:

Table Template:	Select the desired template for the measurement table
Deviation Type:	Select the deviation type
SD/GP Range:	Choose the desired range for the selected “Deviation Type”
In/Output Unit:	Choose the unit for the selected “SD/GP Range” from the drop-down menus
Precision:	Select the precision (# after comma)
Meas. Value:	Select either “Edit manual” or “predefined” If “predefined” is selected, enter the value for Min, Max and Interval.



- Click on this button, to edit the (predefined) Table values.



- Move the mouse pointer to the field desired and press the [Set] key (right trackball key).

- Type in the value and confirm with the **[Enter]** or the **[Tab]** key (keyboard).



Add additional lines.



Delete unwanted lines.

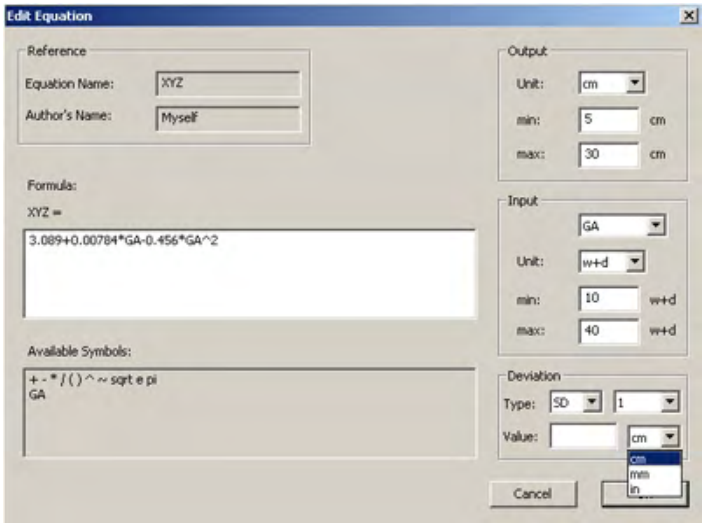


To save the values, click the [Save] button.



To exit without saving, click the [Back] button.

2. **New Equation:** (e.g., Fetal Growth)



- Move the mouse pointer to the field desired and press the [Set] key (right trackball key).

- Type in the equation using the keyboard.

Note *Use only the available symbols and abbreviations!*

+	Addition	**(**	left parenthesis	**sqrt**	Square root
-	Subtraction	**)**	right parenthesis	**e**	natural logarithm (2.71828)
*****	Multiplication	**^**	Square	**pi**	approx. 3.1416 (p)
/	Division	**~**	digit sign (negative)	**.....**	different items (e.g. GA, FL,...)

- Additionally select resp. enter:

Output:	Select the unit and the min and max value of the output.
Input:	Select the item, unit and the min and max value of the input.
Deviation:	Select the Deviation Type, Value and unit.



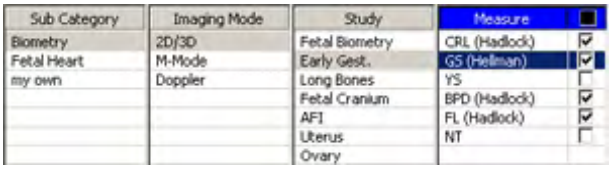
To save the values, click the [Save] button.

To exit without saving, click the [Cancel] button.

After saving, the new table or equation is shown in the “Measure” column.

17.3.1.2 To Delete a Sub Category, Study or Measure Item

1. Select the relevant item in (all) the digest column(s) and then highlight the entry to be deleted. For example: Biometry - 2D/3D - Early Gest. - **GS**



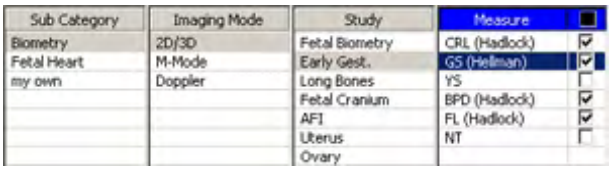


2. Select the [Delete] button.

3. Click the [Yes] button, to confirm the *"Do you really want to delete..."* message, or click on [No] to cancel.

17.3.1.3 To Reorder a Sub Category, Study or Measure Item

1. Select the relevant item in (all) the digest column(s). For example: Biometry - 2D/3D - Early Gest. - **GS**





2. Select the [Reorder] button.

3. Select the item desired (that have to be moved).

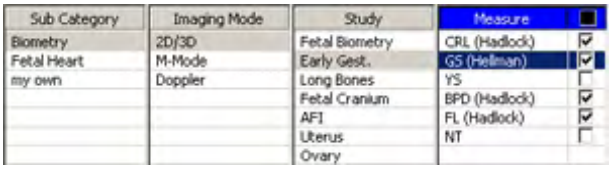


4. By means of these buttons, you can change the position of the selected item.

5. To finish, click the [OK] button.

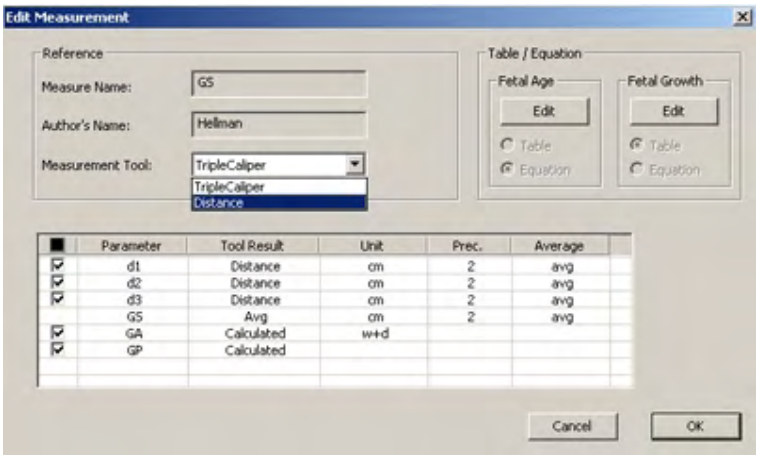
17.3.1.4 To Edit a Sub Category, Study or Measure Item

1. Select the relevant item in (all) the digest column(s) and then highlight the entry to be edited. For example: Biometry - 2D/3D - Early Gest. – **GS**





2. Select the [Edit] button.



Measurement Tool: If available, choose the desired Measurement Tool.

For example: Select, if the GS (Gestational Sack) is to be measured using one Distance (value = GS diameter), or by using 3 Distances (mean value = GS diameter)

"Selection Field": Adjust the display in the worksheet and the measure result field.

- Parameter: set check mark(s) individual or all (check mark in "black box)
- Tool Result: shows parameters to measure and items that will be calculated
- Unit: click into the line desired to change the unit
- Precision: click into the line desired to change the precision (# after comma)
- Average: click into the line desired to change the average display

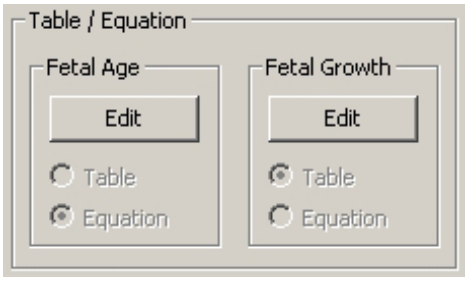
Table / Equation:

- Fetal Age: select either Table or Equation and then click [Edit]
- Fetal Growth: select either Table or Equation and then click [Edit]
- Edit Table Values: If it is desired to edit a table, click this button.

Only "user defined" tables and equations can be edited. Factory default tables and equations can only be viewed!

17.3.1.4.1 To Display the exact Table or Equation

1. Invoke the "Edit Measurement" window. review: To Edit a Sub Category, Study or Measure Item 'To Edit a Sub Category, Study or Measure Item' *on page 17-11*

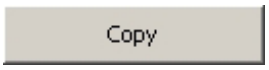


2. To display the exact Fetal Age / Fetal Growth Table or Equation of the selected measurement parameter, click on the [Edit] button of corresponding field.

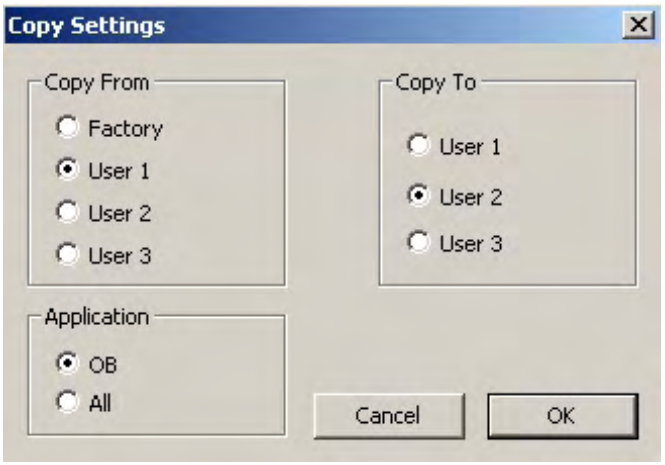


Note *To display the exact table, click on this button.*

17.3.1.5 To Copy Settings

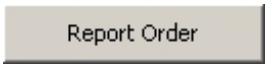


1. Select the [Copy] button in the **Measure & Calc** page.

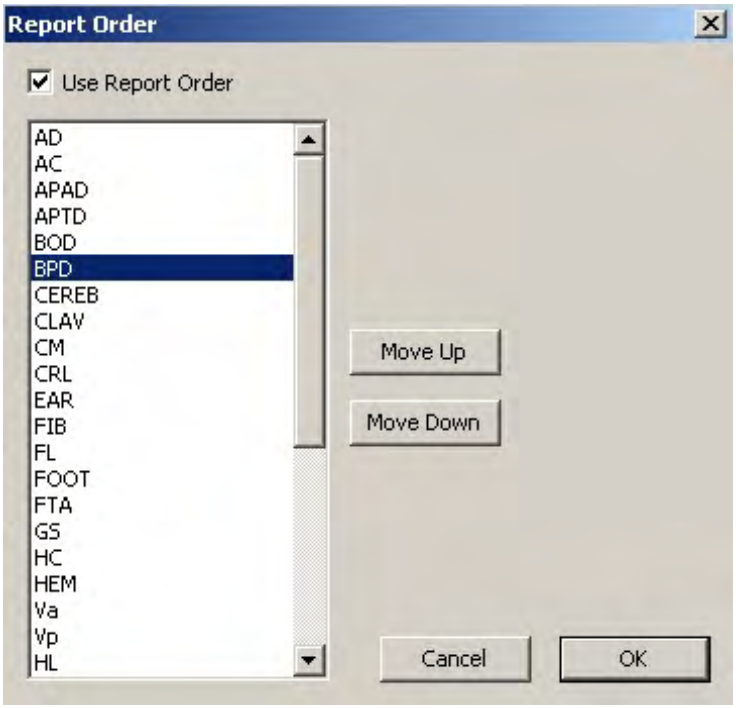


2. Select “Copy From” and “Copy To”. 3. Choose “Application”. 4. To copy the settings, click [OK].

17.3.1.6 To Change the Report Order



1. Select the [Report Order] button in the **Measure & Calc** page.



2. If it is desired, select “Use Report Order” (check mark visible).

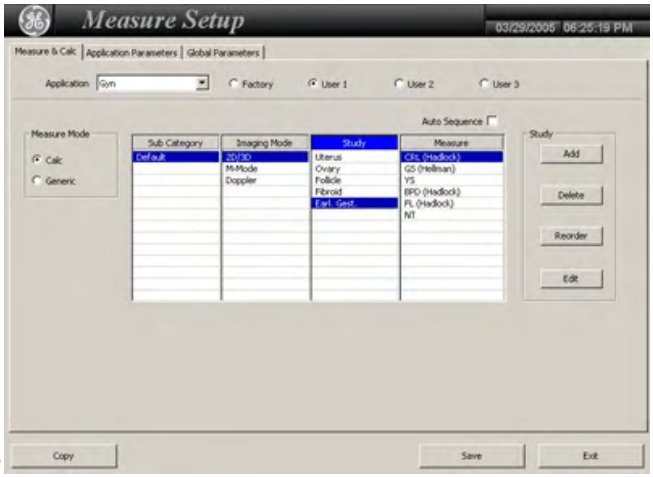
3. Choose the desired measurement parameter (e.g., BPD).

4. Use [Move Up] and [Move Down].

5. To finish, click the [OK] button.

17.3.1.7 First Trimester OB in application GYN

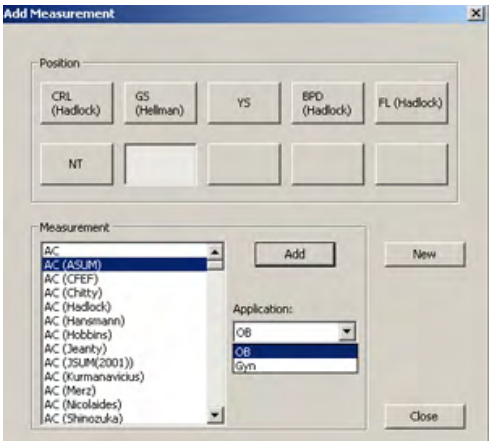
Additional study “Early Gestation” in Factory Presets in application GYN contains the same items as study “Early Gestation” in application OB. Measure items are dependent on “table preselection” in “Global Parameters” menu; review Global Parameters 'Global Parameters' *on page 17-19*





Select the [Add] button.

Following “Add Measurement” menu appears in Gyn application:



It is possible to select the application “OB” from the pull down menu and add OB measurements to the Gyn measurements menu.

Note *Results of OB measurements taken in the application Gyn are still displayed in the OB Report!*

Note *There are two Reports when measuring Gyn and OB items in the application Gyn!*

17.3.1.8 EFW (Estimated Fetal Weight)

Select the section “Fetal Weight Settings” on the “Measure & Calc” page.



Fetal Weight Settings:

Estimation: Select the EFW Formula. Click on this field to create a New, or Edit the setting.

Unit: Select the output unit for EFW.

Age by EFW: Select Table/Formula for calculating the Age from the EFW. Click on this field to create a New, or Edit the setting.

EFW GP/SD: Select Table/Formula for calculating the Growth from the EFW.

Click on this field to create a New, or Edit the setting.

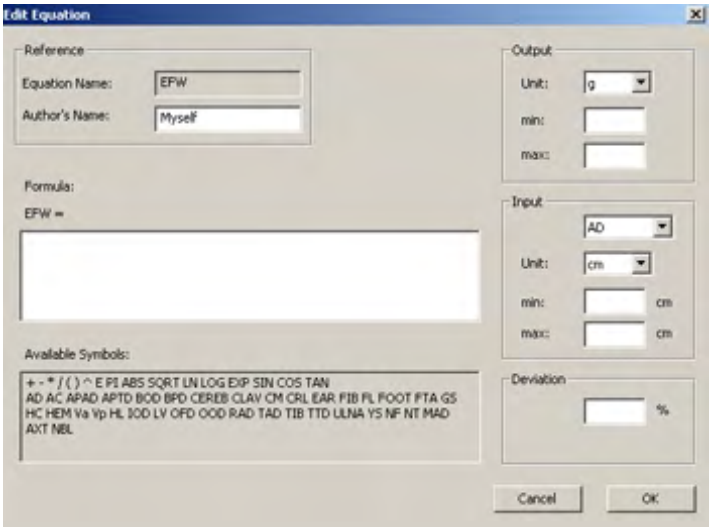
New — Create a new Fetal Weight setting.

Edit — Edit a Fetal Weight setting.

17.3.1.9 Estimation

1. Click on [Estimation] (the display is illuminated and the display about [New] key shows “Estimation”.

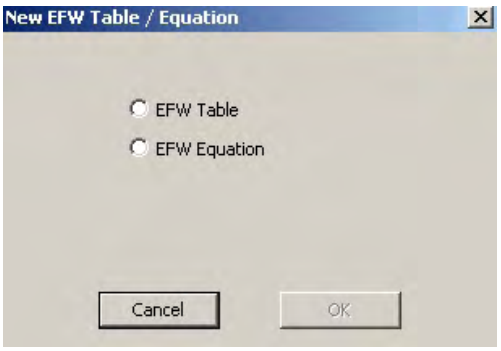
2. Click on [New] key. Following window appears:



17.3.1.10 Age by EFW

1. Click on [Age by EFW] (the display is illuminated and the display about [New] key shows “Age by EFW”).

2. Click on [New] key. Following window appears:



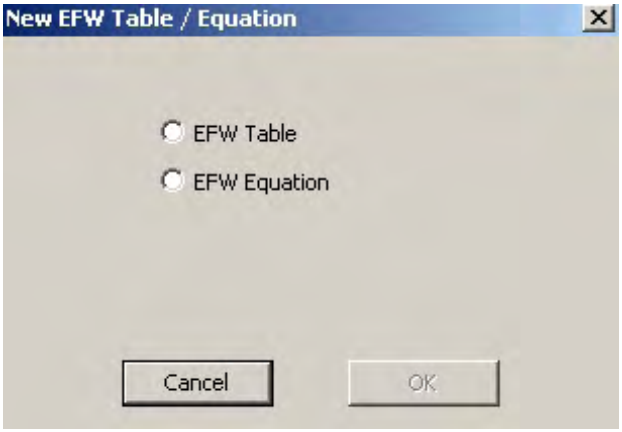
3. Select “EFW Table” or “EFW Equation”.

Remark: Factory preseted tables/equations cannot be edited!

17.3.1.11 EFW GP/SD

1. Click on [EFWGP/SD] (the display is illuminated and the display about [New] key shows “EFW GP/SD”).

2. Click on [New] key. Following window appears:

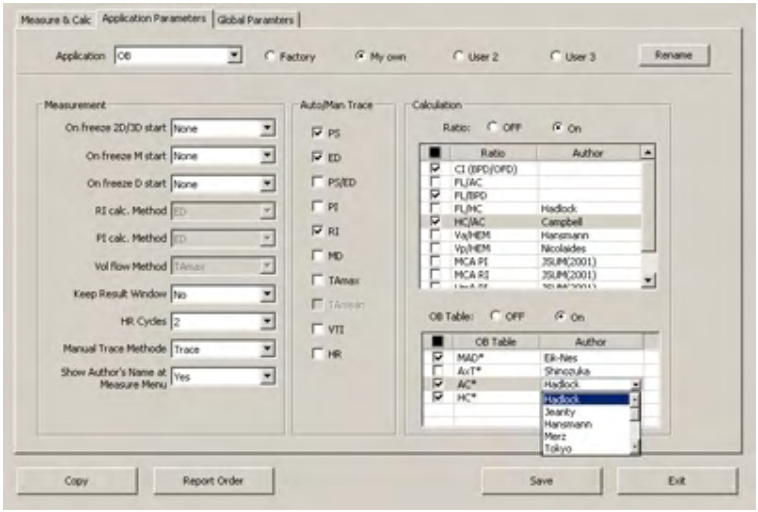


3. Select “EFW Table” or “EFW Equation”.

Remark: Factory preseted tables/equations cannot be edited!

17.3.2 Application Parameters

Application: e.g., **Obstetric**



Parameters and possible adjustments depend on the selected Application.

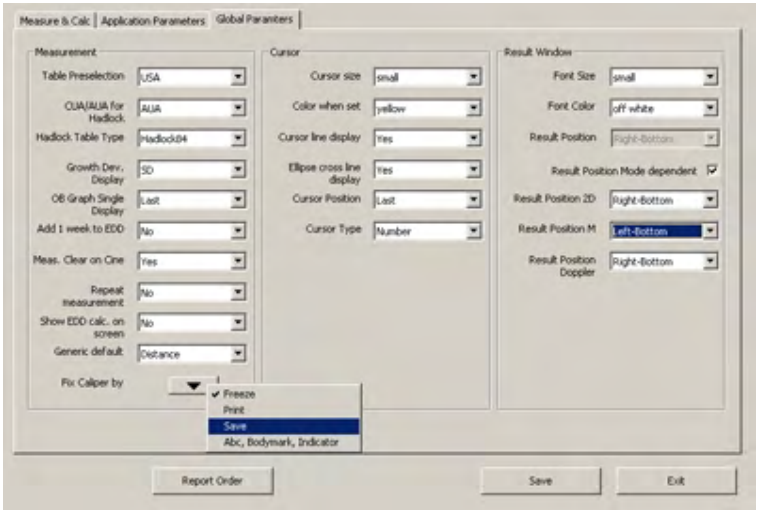
Application:	Select the desired Application (e.g., Obstetric)
Measure Preset:	Select a measure preset (e.g., My own)
Rename	To rename the selected term, click this button.
On freeze 2D/3D start:	Select the status on freeze in 2D/3D mode - None - Calc: Calculation menu appears automatically on Freeze - Generic: Generic measurement menu appears automatically on Freeze - Bodymark: Bodymark menu appears automatically on Freeze
On freeze M start:	Select the status on freeze in M-mode None, Calc, Generic or Bodymark

On freeze D start:	Select the status on freeze in Doppler-mode None, Calc, Generic or Bodymark
RI calc. Method:	ED
PI calc. Method:	ED
Vol. flow Method:	TAmax
Keep Result Window:	Select if all previously set measuring marks are erased when starting a new scan (unfreeze -> Run mode), or if the results will be kept on screen.
HR Cycles:	Select the number of heart rate cycles for measurements.
Manual Trace Method:	Select if the Spectral Doppler envelope curve should be performed with a continuous trace line or by setting points.
Show Author's Name at Measure Menu:	Select if the measurement items in the OB Calculation Menu will be shown with or without the Author's name.
NT Configuration:	Click this button to open a dialog with the following settings: • ***Default Tool:*** Select either ***Distance*** , ***SonoNT - ii*** or ***SonoNT - im*** . • ***Change Control:*** Enable or disable switching between i-i / i-m using the menu soft buttons. • ***Magnification Warning:*** Choose whether to display a warning when the image is insufficiciently magnified.
Auto/Manual Trace:	Select the Doppler measuring results, which should be displayed after each Auto Trace, Manual Trace and Real Time Trace measurement.
Calculation - Ratio:	Select either: Off or On If Ratio is "On" (check mark visible), select the desired ratio calculations that should be displayed in the Patient worklist. (Either select the ratios individual or set only one check mark directly into the "black" box to mark them all.)
OB Table:	Select either: Off or On If OB Table is "On" (check mark visible), select the desired tables that should be displayed in the Patient worklist. (Either select the tables individual or set only one check mark directly into the "black" box to mark them all.)
SonoAVC (Application: GYN):	**Graph:** Define the position of the upper and lower lines for diameter and volume in the graph. **Cut-off Follicles**: Follicles with a smaller diameter or volume than the one given in this fields will be ignored by the algorithm.

Data Transfer:

Condition	Voluson format	DICOM SR format
Only manual follicle measurement available:	Manually measured follicle data is transferred in Standard DICOM SR Tag.	Manually measured follicle data is transferred in Standard DICOM SR Tag.
Manual follicle measurement and SonoAVC measurement available:	SonoAVC data is transferred in private tags, manually measured follicle data is transferred in Standard DICOM SR Tag.	SonoAVC data is transferred once in Standard DICOM SR Tag and once in private tag. Manually measured follicle data is not transferred at all.
Only SonoAVC measurement available:	SonoAVC data is transferred in private tags	SonoAVC data is transferred once in Standard DICOM SR Tag and once in private tag. Manually measured follicle data is not transferred at all.

17.3.3 Global Parameters



Some parameters and possible adjustments depend on the “Table Preselection”.

Table Preselection: Select the desired combination of measurements that fulfil the needs of the respective country.

CUA/AUA for Hadlock: Select to use CUA (Composite Ultrasound Age) or AUA (Average Ultrasound Age) as default.

Hadlock Table Type: Select the desired Table Type.

Growth Dev. Display: Select SD (Standard Deviation) or %.

OB Graph Single Display: Select last or EFW

Add 1 week to EDD: Select Yes or No (to add additional week to estimated date of delivery)

Meas. Clear on Cine: Select if the measurement results should be deleted (= Yes), or kept on screen (= No) as soon as cine mode is activated.

Repeat measurement:	Select if each measurement should be repeated: Generic or Generic&Calc. If each measurement should not be repeated, select No.
Show EDD calc. on screen	Select if EDD (Estimated Day of Delivery) should be calculated and displayed on the screen (= Yes), or not (= No)
Generic default:	Select Distance or last Used
Fix Caliper by Print key:	Select if the last measurement caliper of the currently performed measurement should also be fixed automatically, when - you press the **[Freeze]** key - you press the **[Print A]** or **[Print B]** key - you press the **[Save]** key - you press the **[ABC]** , **[Bodymark]** or **[Indicator]** key **Note:** More than one selections are possible.
Cursor size:	Select the size of the measurement cursor (small or large).
Color when set:	Select the color of a fixed measurement cursor.
Cursor line width:	
Cursor line display:	Select if the cursor line is displayed (= Yes), or if only the cursor number is displayed (= No) after completing a measurement.
Ellipse cross line display:	Select Yes or No
Cursor Position:	Select last or Image center
Cursor Type:	Select Number, Label or Number & Label
Font Size:	Select the font size used in the resulting window (small, medium, large)
Font Color:	Select the font color used in the resulting window
Result Position:	Select the measurement result location on the monitor display.
Result Position Mode dependent:	If desired, set the check mark and then adjust the measurement result location on the monitor display: Result Position 2D Result Position M Result Position of Doppler

17.4 Biopsy Setup

Introduction Programming of Biopsy lines is done in the Biopsy Setup.

Note *Single Angle and Multi Angle Biopsy lines are possible (see Applications 'Applications' on page 18-5 (chapte r 20.5))*

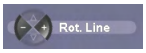
Generally operations are done with the trackball and the Rotation control.



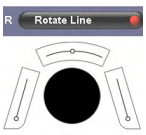
Some parameters and possible adjustments depend on the “Table Preselection”.



The trackball positions the Biopsy line.



Control for rotation of the Biopsy line



Activate the [Rotate Line] key to rotate the Biopsyline with the trackball.

To invoke the Biopsy Setup:

Condition: To invoke the Biopsy Setup, 2D mode must be active.



Press the **[Utilities]** key on the control panel. The monitor changes to the Utilities menu.

Following menu appears, if Single Angle Biopsy is possible for activated probe:





The menu shows the current Biopsy kit.

Select the [Biopsy] item to activate the Biopsy Line programming.

review: To program a Single Angle Biopsy Line ' To program a Single Angle Biopsy Line' *on page 17-22*

Biopsy kit name and the [Biopsy Line] item are dependent on selected probe.

Following menu appears, if Multi Angle Biopsy is possible for activated probe:

17.4.1 To program a Single Angle Biopsy Line



After activation of the “Biopsy” Setup the menu and status area changes to the “Biopsy Setup” menu.

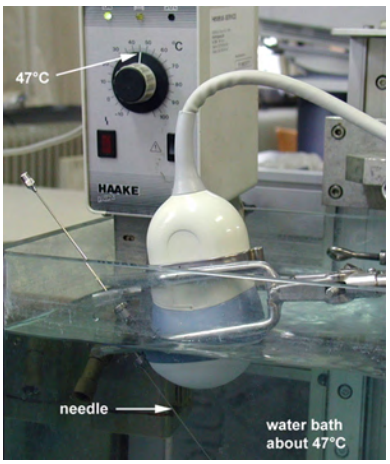
The Biopsy Line appears on the monitor (e.g., RAB4-8RS).

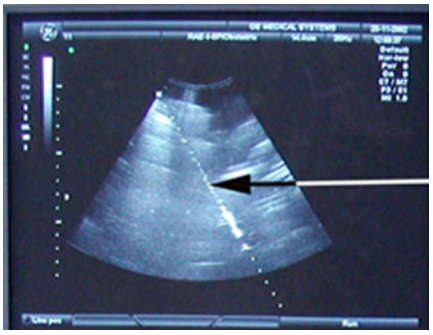


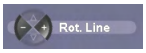
This yellow marker indicates the access point of the needle in the Biopsy Guide!

Operation:

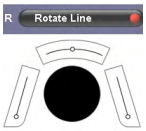
Condition: Place the probe with the biopsy guide secured and with the needle attached into a water bath (**about 47° C, set OTI to “Normal”**) to display the exact position of the needle on the active B image.







Control for rotation of the Biopsy line



Activate the [Rotate Line] key to rotate the Biopsyline with the trackball.
Press the left, right or upper trackballkey to set the rotation.

1. Place the line over the needle echoes by positioning with the trackball and the line rotation control.



2. Select the [Save&Exit] item. The needle line is stored, and exit to the 2D main menu.



Exit to the 2D main menu without saving.



The needle used for this alignment verification must not be used for the actual procedure. Always use a straight, new and sterile needle for each biopsy procedure.

17.4.2 To program a Multi Angle Biopsy Line



After activation of the “Biopsy” Setup the menu and status area changes to the “Biopsy Setup” menu.

The Biopsy Line appears on the monitor.



This yellow marker indicates the access point of the needle in the Biopsy Guide!

The distance between dots is 10mm.

Condition: Place the probe with the biopsy guide secured and with the needle attached into a water bath (**about 47° C, set OTI to "Normal"**) to display the exact position of the needle on the active B image.

The needle used for this alignment verification must not be used for the actual procedure. Always use a straight, new and sterile needle for each biopsy procedure.

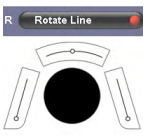
Before starting a biopsy please make sure that in case you want to save a study, all relevant patient information is entered.

---

1. Place the line over the needle echoes by positioning with the trackball.



Control for rotation of the Biopsy line



Activate the [Rotate Line] key to rotate the Biopsyline with the trackball.
Press the left, right or upper trackballkey to set the rotation.

Select the [Store MBX-1] item to store the first line.

Be sure that selected angle on biopsy guide corresponds to selected display line in utilities menu!!

To adjust the MBX-1 line, the MBX-1 position on the Biopsy Guide must be selected!

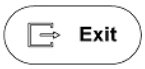
To adjust the MBX-3 position, fix the MBX-3 angle position on the biopsy guide.

1. The [Store MBX-3] item is illuminated.
2. Place the line over the needle echoes by positioning with the trackball.

Note ***Angle is derived from MBX-1 Angle and cannot be changed!***

Select the [Store MBX-3] item to store the second line.

1. Exit to the 2D main menu without saving.



Select the [Exit&Save] item to store biopsy setup.

The MBX-2 line will be automatically calculated.



It is absolutely necessary to ensure that before performing a biopsy, the selected and displayed biopsy line corresponds to the biopsy needle guide mounted to the transducer (left/right).

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Chapter 18

Probes and Biopsies

This chapter contains detailed information about each probe and describes the use of biopsy kits and accessories as well as care and maintenance procedures for different types of probes.

18.1 Intended use, contraindications and patient population

Intended use

Image Acquisition for diagnostic purposes including measurements on acquired image. Extracting tissue samples with guided and freehand biopsy.

Contraindications

Probes are not intended for:

- ophthalmic use or any use causing the acoustic beam to pass through the eye
- intra-operative use

Abdominal and linear probes are not intended for:

- endocavity use

Patient population

- Age: all ages (incl. embryos and fetuses)
- Location: worldwide
- Sex: male and female
- Weight: all weight categories
- Height: no height limitations

18.2 Probe Safety

18.2.1 Handling Precautions



Probes are not delivered sterilely!

It is MANDATORY to clean and disinfect probes before the first usage to avoid infections or disease transmissions.

Ultrasound probes are highly sensitive medical instruments that can easily be damaged by improper handling. Use care when handling and protect from damage when not in use. **DO NOT** use a damaged or defective probe. Failure to follow these precautions can result in serious injury and equipment damage.



Transducer damage can result from contact with inappropriate coupling or cleaning agents.

Do not soak or saturate transducers with solutions containing alcohol, bleach, ammonium chloride compounds, hydrogen peroxide or incompatible solutions as shown on the Care-card!

Avoid contact with solutions or coupling gels containing mineral oil or lanolin.

Inspect the probe prior to use for damage or degeneration to the housing, strain relief, lens and seal.

Note *Sporadically, silicone grease can leak in small amounts from the probes' cable bushing. This leakage is not a failure or harmful to the human body. Silicone grease does not contain any hazardous substances and is only used to seal the cable bushing. In case of leakage wipe the grease away with a cloth.*

When scanning in air (Ultrasound probe is not in contact with a human body or a phantom) most of the ultrasound energy is reflected at the lens - air surface and bounces back and forward between that interface and the transducer ceramics. Already the smallest deviation from the ideal geometrical shape of the reflecting interfaces can cause irregularities in the reverberation pattern across the transducer surface. However, when the probe is coupled to the human skin or a phantom by using coupling gel most of the ultrasound energy passes the lens - skin interface and these small geometrical deviations will have a negligible effect on the ultrasound signal and image quality. Therefore variations of the reverberation pattern along the transducer cannot be used for judging image and transducer quality. The use of a tissue mimicking phantom is strongly recommended to assess image quality.

In case HF surgical equipment is used in combination with an ultrasound probe placed on the patient, the following protective measures have to be taken to avoid the risk of burns to the patient:

- Keep a large distance between the HF surgical field and the applied ultrasound probe
- Ensure that the neutral electrode of the HF surgical equipment is correctly positioned

18.2.2 Watertightness

Attention

All probes labeled "IPX7" are watertight up to a minimum of 5 cm above the probe cable strain relief. If the probe is not explicitly marked as IPX7, the probe up to a minimum of 5 cm above the probe strain relief fulfills IPX1 according to IEC60601-2-37.

For more information see 'Probe Cleaning and Disinfecting Process' *on page 18-12.*

18.2.3 Electrical Shock Hazard

The probe is driven with electrical energy that can injure the patient or user if live internal parts are contacted by conductive solution:

- **DO NOT** immerse the probe into any liquid beyond the immersion level. Probe Cleaning and Disinfecting Process 'Probe Cleaning and Disinfecting Process' *on page 18-12)*. Never immerse the probe connector or probe adaptors into any liquid.
- **DO NOT** drop the probes or subject them to other types of mechanical shock or impact. Degraded performance or damage such as cracks or chips in the housing may result.
- Inspect the probe before and after each use for damage or degradation to the housing, strain relief, lens, and seal. A thorough inspection should be conducted during the cleaning process.
- **DO NOT** kink, tightly coil, or apply excessive force on the probe cable. Insulation failure may result.
- Electrical leakage checks should be performed on a routine basis by GE Service or qualified hospital personnel. Refer to the service manual for leakage check procedures.

Warning

If a probe has dropped on the floor or on any other hard surface, immediately disconnect the probe from the ultrasound system. Do not use the probe any more. There is a risk of electric shock due to damaged electrical insulation.

18.2.4 Mechanical Hazards

A defective probe or excessive force can cause patient injury or probe damage:

- Observe depth markings and do not apply excessive force when inserting or manipulating intracavitary probes.
- Inspect probes for sharp edges or rough surfaces that could injure sensitive tissue.
- Avoid mechanical shock or impact to the transducer and do not apply excessive bending or pulling force to the cable.

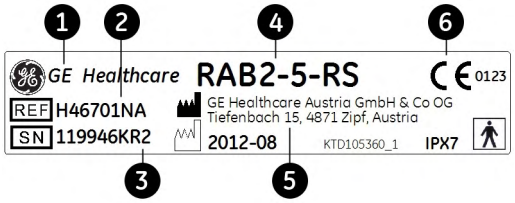
18.2.5 Thermal Safety

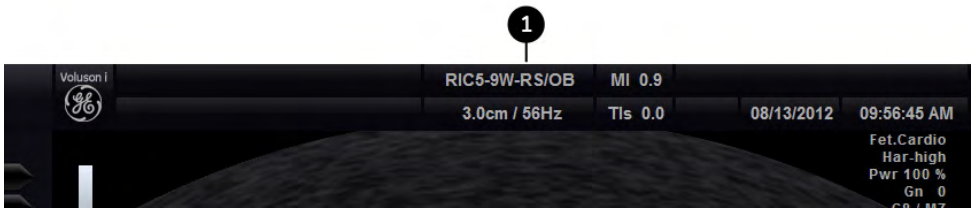
Maintaining a safe thermal environment for the patient has been a design priority at GE Healthcare. The operating temperature of the ultrasound probe stays below 43˚C if used as intended ('Basic Data' *on page 20-2*)

18.3 Labeling

Each probe is labeled with the following information:

Probe designation provided on the probe grip and on top of the connector housing, so it is easily read when mounted on the system. It is also displayed on screen when the probe is selected.

Rating plate:	
	
	1. Company logo and name 2. GE part number 3. Probe serial number 4. Probe type 5. Manufacturer’s adress 6. Type of unit, safety class, production date and CE-marking. Please refer to 'Labels and Symbols' *on page 2-2* for explanations of the symbols.

Rating plate:

Displayed Probe Information (**1** = Probe Information Location)

Note *Probes with the suffix "RS" can only be operated on Voluson® i or Voluson® e systems.*

18.4 Ergonomics

Probes have been ergonomically designed to:

- Handle and manipulate with ease.
- Be connected to the system with one hand.
- Be lightweight and balanced.
- Have rounded edges and smooth surfaces.

Cables have been designed to:

- Connect to system with appropriate cable length.
- Stand up to typical wear with cleaning and using disinfectant agents, contact with approved gel, etc.

18.5 Applications

The manual refers to probes that can be connected to the device. It is possible that some probes are NOT available in some countries.

Some features and options are not available in some countries.

Below is a list of probes and their intended applications.

Probes	Applications									
	ABD	SMP	OB	GYN	CARD	URO	VAS	PED	NEURO	MSK
4C-RS	x	-	x	x	-	-	-	-	-	-
AB2-7-RS	x	-	x	x	-	x	-	x	-	-
E8C-RS	-	-	x	x	-	x	-	-	-	-
IC5-9W-RS	-	-	x	x	-	x	-	-	-	-
12L-RS	-	x	-	-	-	-	x	x	-	x
9L-RS	-	i	i	-	-	-	i	i	-	i
SP10-16-RS	-	i	-	-	-	-	i	i	-	i
RAB2-5-RS	x	-	x	x	-	-	-	-	-	-
RAB4-8-RS	x	-	x	x	-	-	-	x	-	-

Probes	Applications									
	ABD	SMP	OB	GYN	CARD	URO	VAS	PED	NEURO	MSK
RIC5-9-RS	-	-	x	x	-	x	-	-	-	-
RIC5-9W-RS	-	-	x	x	-	x	-	-	-	-
RNA5-9-RS	i	i	i	-	i	-	-	i	-	-
RSP6-16-RS	-	i	-	-	-	-	i	i	-	i

x	supported on Voluson® i and Voluson® e
i	supported only on Voluson® i
*	optional

18.6 Imaging Modes

Probes	2D							M		
	norm	HI	CRI	SRI	FFC	Trapez	BetaView	M	MCFM	MHD Flow
4C-RS	x	x	x	x	x	-	-	x	x	x
AB2-7-RS	x	x	x	x	x	-	-	x	x	x
E8C-RS	x	x	x	x	x	-	-	x	x	x
IC5-9W-RS	x	x	x	x	x	-	-	x	x	x
12L-RS	x	x	x	x	-	x	-	x	-	-
9L-RS	i	i	i	i	-	i	-	i	-	-
SP10-16-RS	i	i	i	i	-	i	-	i	-	-
RAB2-5-RS	x	x	x	x	x	-	-	x	x	x
RAB4-8-RS	x	x	x	x	x	-	-	x	x	x
RIC5-9-RS	x	x	x	x	x	-	x	x	x	x
RIC5-9W-RS	x	x	x	x	x	-	x	x	x	x
RNA5-9-RS	i	i	i	i	i	-	i	i	i	x
RSP6-16-RS	i	i	i	i	-	i	-	i	-	-

Probes	PW				Color		
	Update	Duplex	Triplex	HPRF	CFM	HD-Flow	PD
4C-RS	x	x	x	x	x	x	x
AB2-7-RS	x	x	x	x	x	x	x
E8C-RS	x	x	x	x	x	x	x
IC5-9W-RS	x	x	x	x	x	x	x
12L-RS	x	x	x	-	x	x	x
9L-RS	i	i	i	-	i	i	i
SP10-16-RS	i	i	i	-	i	i	i

Probes	PW				Color		
	Update	Duplex	Triplex	HPRF	CFM	HD-Flow	PD
RAB2-5-RS	x	x	x	x	x	x	x
RAB4-8-RS	x	x	x	x	x	x	x
RIC5-9-RS	x	x	x	x	x	x	x
RIC5-9W-RS	x	x	x	x	x	x	x
RNA5-9-RS	i	i	i	i	i	i	i
RSP6-16-RS	i	i	i	i	i	i	i

Probes	3D							
	2D norm	CFM	PD	HD-Flow	TD	VCI*	BF	Contrast
4C-RS	-	-	-	-	-	-	-	-
AB2-7-RS	-	-	-	-	-	-	-	-
E8C-RS	-	-	-	-	-	-	-	-
IC5-9W-RS	-	-	-	-	-	-	-	-
12L-RS	-	-	-	-	-	-	-	-
9L-RS	-	-	-	-	-	-	-	-
SP10-16-RS	-	-	-	-	-	-	-	-
RAB2-5-RS	x	x	x	x	-	i	-	-
RAB4-8-RS	x	x	x	x	-	i	-	-
RIC5-9-RS	x	x	x	x	-	i	-	-
RIC5-9W-RS	x	x	x	x	-	i	-	-
RNA5-9-RS	x	x	x	x	-	i	-	-
RSP6-16-RS	x	x	x	x	-	i	-	-

Probes	4D				XTD*	STIC*			
	norm	Biopsy	VCI	Contrast	XTD	norm	CFM	PD	HD-Flow
4C-RS	-	-	-	-	x	-	-	-	-
AB2-7-RS	-	-	-	-	x	-	-	-	-
E8C-RS	-	-	-	-	x	-	-	-	-
IC5-9W-RS	-	-	-	-	x	-	-	-	-
12L-RS	-	-	-	-	x	-	-	-	-
9L-RS	-	-	-	-	i	-	-	-	-
SP10-16-RS	-	-	-	-	i	-	-	-	-
RAB2-5-RS	x	i	i	-	x	i	i	i	i
RAB4-8-RS	x	i	i	-	x	i	i	i	i
RIC5-9-RS	x	i	i	-	x	i	i	i	i
RIC5-9W-RS	x	i	i	-	x	i	i	i	i

Probes	4D				XTD*	STIC*			
	norm	Biopsy	VCI	Contrast	XTD	norm	CFM	PD	HD-Flow
RNA5-9-RS	x	i	i	-	i	i	i	i	i
RSP6-16-RS	x	i	i	-	x	i	i	i	i

x	supported on Voluson® i and Voluson® e
i	supported only on Voluson® i
*	optional

18.7 Settings

Probe Designation	All Modes	Doppler Frequency		
	Center Image Frequency [MHz] (Probe specific)	Low	Mid	High
4C-RS	3.1	2.00	2.73	3.33
AB2-7-RS	4.3	2.73	3.33	4.29
E8C-RS	6.5	5.00	6.00	7.50
IC5-9W-RS	5.9	5.00	6.00	7.50
12L-RS	7.7	5.00	6.00	7.50
9L-RS	5.3	5.00	6.00	7.50
SP10-16-RS	12.0	6.00	7.50	10.00
RAB2-5-RS	3.2	2.00	2.73	3.75
RAB4-8-RS	4.4	3.00	3.75	4.29
RIC5-9-RS	6.6	5.00	6.00	7.50
RIC5-9W-RS	6.6	5.00	6.00	7.50
RNA5-9-RS	6.1	3.75	4.29	5.00
RSP6-16-RS	11.5	5.00	6.00	7.50

x	supported on Voluson® i and Voluson® e
i	supported only on Voluson® i
*	optional

18.8 Probe Usage

For details on connecting, activating, deactivating, disconnecting, transporting and storing the probes, refer to:

- Transducer Connection 'Transducer Connection' *on page 4-3*
- Probe/Program Selection ' Probe/Program Selection' *on page 4-4*

18.8.1 Cable Handling

Take the following precautions with probe cables:

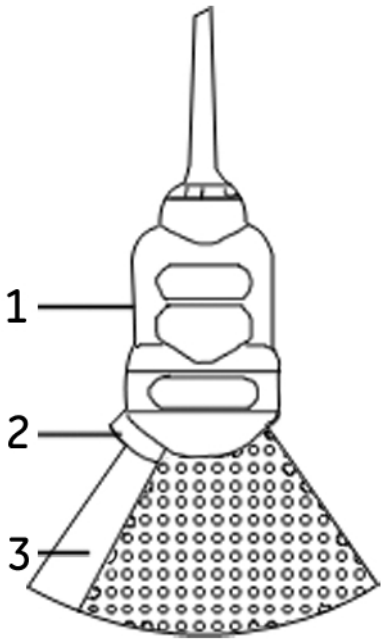
- Keep away from wheels.
- Do not bend the cable acutely.
- Avoid crossing cables between probes.

18.8.2 Probe Orientation

Each probe is provided with an orientation marking. This mark is used to identify the side of the probe corresponding to the side of the image having the orientation mark on the display.

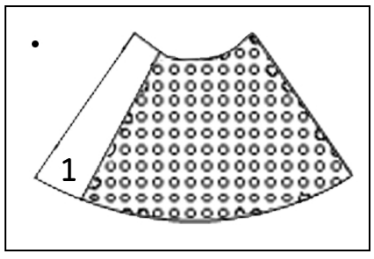
Transducer:

1. marks for direction of insonation
2. finger
3. shadowing



Monitor:

1. shadowing



18.8.3 Coupling Gels

Do not use unrecommended gels (lubricants). They may damage the probe and void the warranty.

Please consider our constantly updated Care-Card (which is inside the transducer boxes) for disinfectants and gels that are compatible with the surface material of the probes!

Applying:

In order to ensure optimal transmission of sound waves between the patient and probe, a conductive gel or couplant must be applied on the patient's skin where scanning will be performed.

Precautions:

Coupling gels should not contain the following ingredients, as they are known to cause probe damage:

- Methanol, ethanol, isopropanol, or any other alcohol-based product
- Mineral oil
- Iodine
- Lotions
- Lanolin
- Aloe Vera
- Olive Oil
- Methyl or Ethyl Parabens (para hydroxybenzoic acid)
- Dimethylsilicone

18.9 Special Handling Instructions

18.9.1 Using Protective Sheaths

Protective barriers may be required to minimize disease transmission. Probe sheaths are available for use with all clinical situations where infection is a concern. Legally marketed, sterile probe sheaths MUST BE USED for intracavitary procedures. Use of legally marketed probe sheaths is MANDATORY.

Instructions: Custom-made sheaths are available for each probe. Each probe sheath kit consists of a flexible sheath used to cover the probe and cable and elastic bands used to secure the sheath.

Sterile probe sheaths are supplied as part of disposable biopsy kits for those probes intended for use in biopsy procedures. In addition to the sheath and elastic bands, there are associated accessories for performing a biopsy procedure which are included in the kit. Refer to the biopsy instructions for the specific probes in the Discussion section of this chapter for further information.

Devices containing latex may cause severe allergic reaction in latex sensitive individuals. Refer to FDA's March 29, 1991 Medical Alert on latex products.

DO NOT use pre-lubricated condoms as a sheath.

In some cases, they may damage the probe. Lubricants in these condoms may not be compatible with probe construction.

DO NOT use an expired probe sheath.

Before using probe sheaths, verify whether the term of validity has expired.

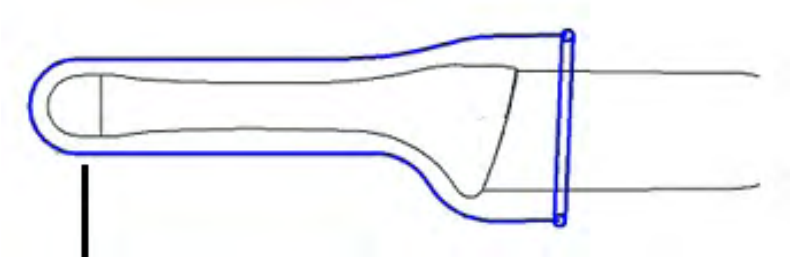
18.9.2 Preparing the Transducer

- Use a sufficient amount of coupling gel!
- Take care to use only reinforced finger cots and probe sheaths, normal ones tear very easily!

Procedure:

1. Put coupling gel on the transducer tip and pull the long sheath over the shaft.
2. Apply a sufficient amount of coupling gel on the area of the acoustic window.

VOLUSON® ENDOCAVITY TRANSDUCER RIC5-9 -RS, RIC5-9W-RS



Medical Probe Sheath

18.10 Probe Handling and Infection Control

This information is intended to increase user awareness of the risks of disease transmission associated with using this equipment and provide guidance in making decisions directly affecting the safety of the patient as well as the equipment user.

Diagnostic ultrasound systems utilize ultrasound energy that must be coupled to the patient by direct physical contact. Depending on the type of examination, this contact occurs with a variety of tissues ranging from intact skin in a routine exam to recirculating blood in a surgical procedure.

The level of risk of infection varies greatly with the type of contact.

One of the most effective ways to prevent transmission between patients is with single use or disposable devices. However, ultrasound transducers are complex and expensive devices that must be reused between patients. It is very important, therefore, to minimize the risk of disease transmission by using barriers and through proper processing between patients.

18.10.1 Probe Cleaning and Disinfecting Process

Adequate cleaning and disinfection is necessary to prevent disease transmission. It is the responsibility of the equipment user to verify and maintain the effectiveness of the infection control procedures in use.



High-level disinfection is recommended for surface probes and is required for endocavity probes. Additional to disinfection the use of sterile, legally marketed probe sheaths for intracavitary procedures is MANDATORY.

Ultrasound probes can be disinfected using liquid chemical germicides. The level of disinfection is directly related to the duration of contact with the germicide. Increased contact time produces a higher level of disinfection.



CREUTZFELD-JACOB DISEASE

Neurological use on patients with this disease must be avoided. If a probe becomes contaminated, there are no adequate disinfecting means.

Recommendation for cleaning and disinfection of ultrasound probes:

1. Remove the probe sheath, if appropriate.
2. Disconnect the probe from the ultrasound console.
3. Remove all coupling gel and other visible substances from the probe by wiping with a soft dry cloth. If necessary to remove material dried to the surface the cloth can be moistened with lukewarm water.
4. After each use, inspect the probe's lens, cable, and housing. Look for any damage that would allow liquid to enter the probe. If any damage is found, the probe must not be placed into any liquid (e.g. for disinfection) and must not be used until it has been inspected and repaired/replaced by a GE Healthcare Austria GmbH & Co OG Service Representative.

Please consult our constantly updated Probe Care Card (which is inside the transducer boxes) for disinfectants and gels that are compatible with the surface material of the probes!

The most current version can be found on the web:

http://www.gehealthcare.com/transducers

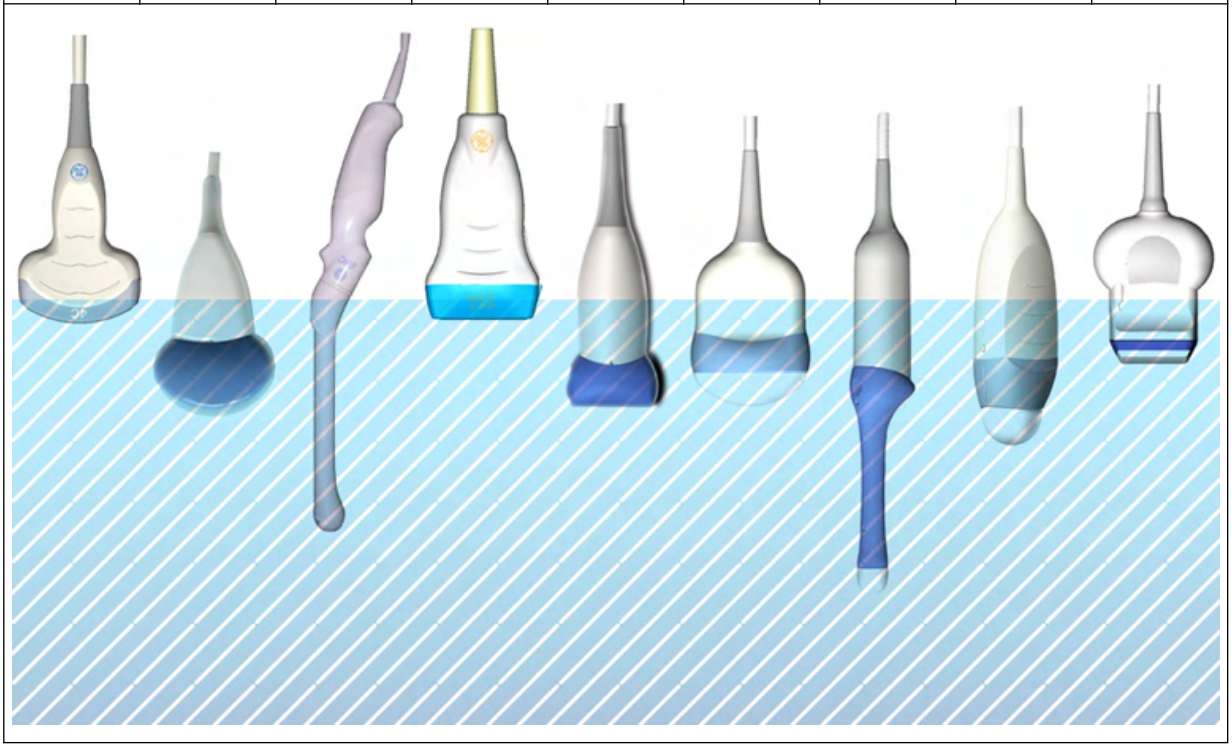
The listed products have been validated for appropriate cleaning and disinfection of the probes.

One of the recommended methods to disinfect the ultrasound probes is immersion disinfection:

1. Place the probe into the solution of cleaning-disinfectant. Make sure not to immerse the probe into the liquid beyond the immersion level given in the pictures below. Make sure that the probe is covered with the cleaning-disinfectant up to the immersion level during the complete disinfection time. Leave the ultrasound probe in the solution for the time specified by the manufacturer, see Probe Care Card.
2. Scrub the probe as needed using a soft sponge, gauze, or cloth to remove all visible residue from the probe surface. Prolonged soaking or scrubbing with a soft bristle brush (such as a toothbrush) may be necessary if material has dried onto the probe surface.
3. Rinse the probe with enough clean, potable water to remove all disinfectant residues.
4. Use a soft cloth to clean the cable and the user section of the probe with the cleaning-disinfectant liquid. Make sure that the surface of the probe and cable is wetted thoroughly with the cleaning-disinfectant.

5. Allow probe to air dry completely.
6. Reconnect the probe to the ultrasound console and place the probe into its holder.
7. Inspect the probe prior to use for damage or degeneration to the housing, strain relief, lens and seal. Do not use a damaged or defective probe until it has been inspected and repaired/replaced by a GE Healthcare Austria GmbH & Co OG Service Representative.
8. Put a new sterile, legally marketed probe sheath over the probe prior to next use.

Other appropriate disinfection methods for ultrasound probes, such as wipe disinfection, may be applied as an alternative to disinfection by immersion, provided that the products listed in the Probe Care Card are used.

Probe immersion levels:								
4C-RS	AB2-7-RS	E8C-RS IC5-9W-RS	12L-RS 9L-RS	SP10-16-RS	RAB2-5-RS RAB4-8-RS	RIC5-9-RS RIC5-9W-RS	RNA5-9-RS	RSP6-16-RS
								

18.11 Care and Maintenance

18.11.1 Inspecting Probes

After each use, inspect the probe's lens, cable, and casing. Look for any damage that would allow liquid to enter the probe. If any damage is found, the probe must not be placed into any liquid (e.g. for disinfection) and must not be used until it has been inspected and repaired/replaced by a GE Healthcare Austria GmbH & CO OG Representative.

Note *Keep a log of all probe maintenance, along with a picture of any probe malfunction.*

18.11.2 Environmental Requirements

Probes must be operated, stored, or transported within the parameters outlined below.

Ensure that the probe face temperature does not exceed the normal operation temperature range.

Probe Environmental Requirements

	Operational	Storage	Transport
Temperature	+18º to +30º C	-10º to +50º C	-10º to +50º C
Humidity	30% to 75% non-condensing	10% to 85% non-condensing	10% to 85% non-condensing
Pressure	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa	700hPa (3000m) to 1060hPa

18.11.3 Planned Maintenance

The following maintenance schedule is suggested for the system, probe and reusable biopsy / biopsy bracket to ensure optimum operation and safety.

Do the Following	Daily	After Each Use	As Necessary
Inspect the Probes	X		X
Clean the Probes		X	X
Disinfect Probes		X	X

18.11.4 Disposal

For more information see 'Disposal' *on page 2-15.*



- Probes must be cleaned and disinfected before they are replaced or disposed.
- Dispose of single-use components as infectious waste.
- Reusable biopsy guides must be sterilized before they are disposed!

18.12 Biopsy Special Concerns

- Prepare the patient according to the usual procedures for the purpose.
- An ultrasound examination with this system must be performed either under supervision, or by adequately trained and qualified medical staff.



A biopsy must only be performed by physicians with adequate experience. Under all circumstances the necessary safety precautions and sterility measures have to be respected.



Biopsy needles and biopsy guides are not delivered sterile unless it is clearly labeled!
If biopsy-equipment is not sterile it is MANDATORY to clean and disinfect biopsy needles and biopsy guides before the first usage to avoid infections or disease transmissions! If available, please also consult accompanying documents delivered with the biopsy-equipment.

It is absolutely necessary to ensure that before performing a biopsy, the selected and displayed biopsy line corresponds to the biopsy needle guide mounted to the transducer (left/right).

There may be restrictions on performing in vitro fertilization (IVF), chorionic villus sampling (CVS) and percutaneous umbilical blood sampling (PUBS) procedures. Please consider the local laws and regulations.

Before starting a biopsy please make sure that in case you want to save a study, all relevant patient information is entered.

Do not use needle guide if it appears to be damaged.

A standard needle guide is packaged non-sterile and is reusable. To avoid possible patient contamination, ensure needle guide is properly cleaned and sterilized before each use.

If the material of the biopsy needle guide is plastic, **only** Single-Use is possible!

Plastic biopsy brackets are reusable.

Please refer to the manufacturer's instructions included in the biopsy kit.

All biopsy guides depicted and described in this user manual have been validated for use with the system and software. If biopsy guides which are not listed in this user manual are used, the operator has the possibility to configure and store the predicted biopsy line for this guide. In this case the user has to be aware that this biopsy guide/probe/system/software combination may not be validated by GE Healthcare Austria GmbH & Co OG and therefore responsibility for correct configuration and usage lies with the user.

18.12.1 Mounting

Refer to the biopsy guide's user manual for detailed information on how to mount and use the biopsy guide.

- All biopsy needle guides can easily be mounted to the transducer. Biopsy guides have a special stop or handle to guarantee a good fix into the notch of transducers.
- The cold-sterilized transducer can be kept sterile by placing a sterile sheath over the shaft (sterile coupling gel between transducer and sheath).

Sterilization for reusable biopsy needle guides:

Autoclaving (moist heat) 121ºC (3 pre-vacuum cycles) for 20 minutes or 134ºC for 5 minutes
Recommended minimum sterilization level SAL 10^{-6} .

Ensure the correct position and optimal fit every time before using a biopsy guide! The stainless steel tube (and the bore inside) of the biopsy needle guide must be sterile.

18.12.2 Cleaning and disinfecting biopsy guides

Cleaning and Sterilization of reusable Biopsy Guides: (for disposable biopsy guides, please regard enclosed manuals):



After each use, remove needle guide from transducer. Remove visible contaminants from needle guide surface thoroughly,using a small, soft instrument brush. Take special care of all narrow areas and tubes. Keep needle guide from drying out until complete cleaning can be accomplished. After that, soak needle guide for minimum of five minutes in neutral pH, low foamingenzymatic detergent.

While immersed, use instrument brush to remove trapped contaminants from Surfaces, holes and tubes. If visible contaminants cannot be easily removed, repeat soaking procedure for an additional five minutes. Remove needle guide from cleaning solution and remove any remaining residue with dry wipe. Follow cleaning solution manufacturer’s directions for use and recommendations for concentration.



Dispose of single-use components as infectious waste.

18.12.3 Programming and Display

Immerse the transducer with the mounted biopsy needle guide in a vessel filled with warm water (approx. 47ºC or 117ºF).

Insert the needle into the needle guide, until a needle echo can be seen in the ultrasound image. Set the power setting and the gain setting to the minimum necessary for a good result. For further instructions review:

- To program a Single Angle Biopsy Line ' To program a Single Angle Biopsy Line' *on page 17-22*
- To program a Multi Angle Biopsy Line 'To program a Multi Angle Biopsy Line' *on page 17-23*

18.13 Overview of all probes and biopsies



Slight noise emissions may occur in 3D/4D probes, when operating in volume mode!



If the material of the biopsy needle guide is plastic, **only** Single-Use is possible!

The biopsy bracket is reusable.

For detailed information, please contact the manufacturer.



The high elasticity of the probe surface ensures an optimal coupling of the probe. This elasticity can lead to small deformations of the applied part.

The intended use of the probe will be in no way affected by this deformation, and leads to no loss of the ultrasound image quality.

18.13.1 3D/4D Probes: Curved Array (Convex) Probes

18.13.1.1 RAB2-5-RS Abdominal transducer

<table>
<tr><th colspan="2">RAB2-5-RS</th><th>Biopsy PEC74/ H48621Y</th><th>Biopsy PEC78/ H46701AE</th></tr>
<tr><td colspan="2"> 

(1) Patient-applied part
(2) Probe handle</td><td> 
</td><td>  </td></tr>
<tr><th>Applications</th><th>Features</th><th>Features</th><th>Features</th></tr>
<tr><td>• Abdomen
• Gynecology
• Obstetrics</td><td>• 3D/4D Real Time imaging
• Small and light weight
• Biopsy guide available
• CFM, MCFM, HD-Flow, PD and PW
• Broad bandwidth, Multi-frequency</td><td>• Needle diameters:
< 1 mm
< 1.4 mm
< 2.2 mm
• Material:
Stainless Steel
• Sterilization with autoclave possible!</td><td>• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
• Material
Plastic
• Only the biopsy bracket is reusable.
• For detailed information, please contact the manufacturer.</td></tr>
</table>

18.13.1.2 RAB4-8-RS Abdominal transducer

<table>
<tr><th colspan="2">RAB4-8-RS</th><th>Biopsy PEC74/ H48621Y</th><th>Biopsy PEC78/ H46701AE</th></tr>
<tr><td colspan="2"> 

(1) Patient-applied part
(2) Probe handle</td><td> 
</td><td>  </td></tr>
<tr><th>Applications</th><th>Features</th><th>Features</th><th>Features</th></tr>
<tr><td>• Abdomen
• Gynecology
• Obstetrics
• Pediatrics</td><td>• 3D/4D Real Time imaging
• Small and light weight
• Biopsy guide available
• CFM, MCFM, HD-Flow, PD and PW
• Broad bandwidth, Multi-frequency</td><td>• Needle diameters:
< 1 mm
< 1.4 mm
< 2.2 mm
• Material:
Stainless Steel
• Sterilization with autoclave possible!</td><td>• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
• Material
Plastic
• Only the biopsy bracket is reusable.
• For detailed information, please contact the manufacturer.</td></tr>
</table>

18.13.1.3 RIC5-9-RS Endocavity transducer

RIC5-9-RS		Biopsy PEC63/ H46721R	Biopsy H48681GF/ H48691Z*/ 134-153
 (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Urology • Gynecology • Obstetrics	• 3D/4D Real Time imaging • Small probe tip and shaft • CFM, MCFM, HD-Flow, PD and PW • Broad bandwidth, Multi-frequency • Biopsy guide available	• Needle diameters: < 1.8 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: > 1.2 mm < 1.6 mm • Material Plastic • Sterile packaged component. • Single-Use only! • *with latex cover • For detailed information, please contact the manufacturer.

18.13.1.4 RIC5-9W-RS Endocavity transducer

RIC5-9W-RS		Biopsy PEC63/ H46721R	Biopsy H48681GF/ H48691Z*/ 134-153
 (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Urology • Gynecology • Obstetrics	• 3D/4D Real Time imaging • Small probe tip and shaft • CFM, MCFM, PD and PW • Broad bandwidth, Multi-frequency • Biopsy guide available	• Needle diameters: < 1.8 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: > 1.2 mm < 1.6 mm • Material Plastic • Sterile packaged component. • Single-Use only! • *with latex cover • For detailed information, please contact the manufacturer.

18.13.1.5 RNA5-9-RS Neonatal transducer

Note *This probe is only available on Voluson® i.*

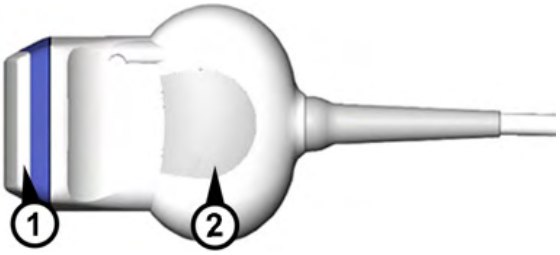
<table>
<tr><th colspan="2">RNA5-9-RS</th><th>Biopsy PEC76/
H48651DG</th><th>Biopsy PEC77/
H46701AF</th></tr>
<tr><td colspan="2"> 

(1) Patient-applied part
(2) Probe handle</td><td>  </td><td> 
</td></tr>
<tr><th>Applications</th><th>Features</th><th>Features</th><th>Features</th></tr>
<tr><td>• Abdominal
• Small-Parts
• Cardiology
• Paediatrics
• Obstetrics</td><td>• 3D/4D Real Time imaging
• CFM, MCFM, HD-Flow, PD and PW
• Broad bandwidth, Multi-frequency
• Biopsy guide available</td><td>• Needle diameters:
< 1 mm
< 2.2 mm
< 2.9 mm
• Material:
Stainless Steel
• Sterilization with autoclave possible!</td><td>• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
• Material
Plastic
• Only the biopsy bracket is reusable.
• For detailed information, please contact the manufacturer.</td></tr>
</table>

18.13.2 3D/4D Probes: Linear Array Probes

18.13.2.1 RSP6-16-RS Abdominal transducer

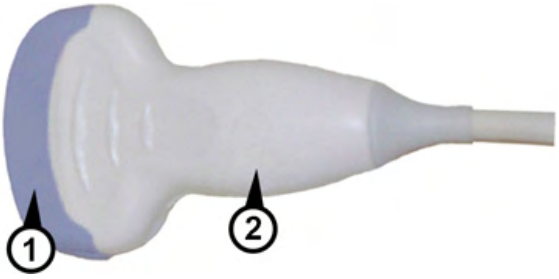
Note *This probe is only available on Voluson® i.*

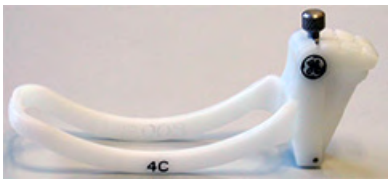
<table>
<tr><th colspan="2">RSP6-16-RS</th><th>Biopsy PEC75 H46721W</th><th>Biopsy PEC79/
H46701AD</th></tr>
<tr><td colspan="2"> 

(1) Patient-applied part
(2) Probe handle</td><td> 
</td><td>  </td></tr>
<tr><th>Applications</th><th>Features</th><th>Features</th><th>Features</th></tr>
<tr><td>• Small-Parts
• Peripheral vascular
• Paediatrics
• MSK (superficial)</td><td>• 3D/4D Real Time imaging
• Biopsy guide available
• CFM, HD-Flow, PD and PW
• Broad bandwidth, Multi-frequency</td><td>• Needle diameters:
< 1 mm
< 1.4 mm
< 2.2 mm
• Material:
Stainless Steel
• Sterilization with autoclave possible!</td><td>• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
• Material
Plastic
• Only the biopsy bracket is reusable.
• For detailed information, please contact the manufacturer.</td></tr>
</table>

18.13.3 2D Probes: Curved Array (Convex) Probes

18.13.3.1 4C-RS Curved array transducer

<table>
<tr><th colspan="2">4C-RS</th><th>Biopsy E8385NA</th></tr>
<tr><td colspan="2"> 

(1) Patient-applied part
(2) Probe handle</td><td> 
</td></tr>
<tr><th>Applications</th><th>Features</th><th>Features</th></tr>
<tr><td>• Obstetrics
• Abdominal
• Gynaecology</td><td>• Biopsy guide available
• CFM, MCFM, HD-Flow, PD and PW
• Broad bandwidth, Multi-frequency</td><td>• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
• Material:
Plastic
• Multi-angle biopsy
• Only the biopsy bracket is reusable.
• For detailed information, please contact the manufacturer.</td></tr>
</table>

18.13.4 2D Probes: Linear Array Probes

18.13.4.1 12L-RS Linear array transducer

<table>
<tr><th colspan="2">12L-RS</th><th>Biopsy H40432LC</th></tr>
<tr><td colspan="2"> 

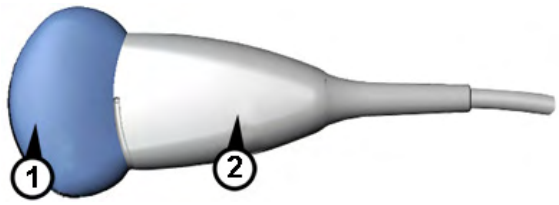
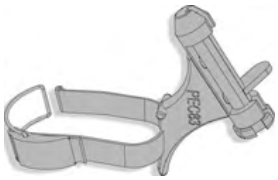
(1) Patient-applied part
(2) Probe handle</td><td> 
</td></tr>
<tr><th>Applications</th><th>Features</th><th>Features</th></tr>
<tr><td>• Small parts
• Peripheral vascular
• Pediatrics
• MSK</td><td>• Biopsy guide available
• Broad bandwidth, Multi-frequency
• CFM, PD and PW</td><td>• Only CIVCO (manufacturer) needle guides may be used with this biopsy.
• Material:
Plastic
• Multi-angle biopsy
• Only the biopsy bracket is reusable.
• For detailed information, please contact the manufacturer.</td></tr>
</table>

18.13.4.2 9L-RS Linear array transducer

Note *This probe is only available on Voluson® i.*

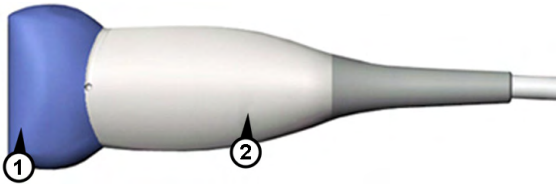
9L-RS		Biopsy H4906BK
 (1) Patient-applied part (2) Probe handle		
Applications	**Features**	**Features**
• Small parts • Obstetrics • Peripheral vascular • Pediatrics • MSK	• CFM, Power and PW Doppler • Small and lightweight	• Only CIVCO (manufacturer) needle guides may be used with this biopsy. • Material: Plastic • Only the biopsy bracket is reusable. • For detailed information, please contact the manufacturer.

18.13.4.3 AB2-7-RS Curved array transducer

AB2-7-RS		Biopsy PEC71/ H46721D	Biopsy PEC83/ H48671ME
 (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Abdomen • Obstetrics • Gynecology • Pediatrics • Urology	• Biopsy guide available • CFM, MCFM, HD-Flow, PD and PW • Broad bandwidth, Multi-frequency	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!

18.13.4.4 SP10-16-RS Linear array transducer

Note *This probe is only available on Voluson® i.*

SP10-16-RS		Biopsy PEC64/ H46721B	Biopsy PEC82/ H48671MD
 (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Small parts • Peripheral vascular • Pediatrics • MSK	• Small and light weight • Broad bandwidth, Multi-frequency • Excellent detail resolution • CFM, HD-Flow, PD and PW	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: < 1 mm < 1.4 mm < 2.2 mm • Material: Stainless Steel • Sterilization with autoclave possible!

18.13.5 2D Probes: Endocavitary Probes

18.13.5.1 E8C-RS Endocavitary Probe

E8C-RS		Biopsy H40412LN	Biopsy E8385MJ
 (1) Patient-applied part (2) Probe handle			
Applications	**Features**	**Features**	**Features**
• Gynecology • Obstetrics • Urology	• Small probe tip and shaft • Broad bandwidth, Multifrequency • CFM, MCFM, HD-Flow, PD and PW • Biopsy guide available	• Needle diameters: < 1.6 mm • Material: Stainless Steel • Sterilization with autoclave possible!	• Needle diameters: < 1.65 mm • Material: Plastic • Sterile packaged component. • Single use only! • For detailed information, please contact the manufacturer.

18.13.5.2 IC5-9W-RS Endocavitary Probe

<table>
<tr><th colspan="2">IC5-9W-RS</th><th>H46701RC</th></tr>
<tr><td colspan="2"> 

(1) Patient-applied part
(2) Probe handle</td><td> 
</td></tr>
<tr><td>Applications</td><td>Features</td><td>Features</td></tr>
<tr><td>• Obstetrics
• Gynaecology
• Urology</td><td>• Biopsy guide available
• Small probe tip and shaft
• CFM, MCFM, HD-Flow, PD and PW
• Broad bandwidth, Multi-frequency</td><td>• Material:
Plastic
• Single-Use only!
• Biopsy guide is disposable.
• For detailed information, please contact the manufacturer</td></tr>
</table>

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Chapter 19

Peripherals and Optional Items

Describes all connections of external devices and optional items.

19.1 How to Connect Auxiliary Devices Safely

The first mounting and connecting will usually be performed by a GE system technician.

How to connect peripheral devices:

1. Ensure that the console is switched off.
2. Connect the peripheral device to the console.
3. Switch on the peripheral device by pressing the Power ON button.
4. Switch on the circuit breaker of the console and press the ***standby*** button.

Note *Always observe the instructions given in the manual of the peripheral/auxiliary device.*

Basic Concept:

The Voluson® i is equipped with an isolation transformer to provide the required separation from AC mains.

The Voluson® i provides several inputs and outputs (I/O) such as Audio, Video, Ethernet, USB, DICOM and Printer signals. Special care must be taken when connecting auxiliary devices via these input and output (I/O) connections.

The IEC 60601 standard provides a guideline for safely interconnecting medical devices in systems.

Everybody who connects additional equipment to the signal input portion or signal output portion configures a medical system, and is therefore responsible that the system complies with the requirements of the system standard IEC 60601. If in doubt, consult the technical service department or your local representative."

1. The medical device may be connected to a single IEC XXX device (protection class I) placed in a room which is not medically used.
2. If the device is to be connected in a medically-used room the following rule applies:

- IEC XXX compliant devices (protection class I) may be connected with an additional safety measure.

- IEC 60601 compliant devices may be connected as such.

For all situations 1 and 2, the additional device shall be installed outside the typical patient environment.

Possible additional safety measures are:

Additional protective earth connection between the 2 devices, or a safety isolation mains transformer for the other device.

Special care has to be taken, if the device is connected to a computer network (e.g., Ethernet), because other devices could be connected without any control. There could be a potential difference between the protective earth and any line of the computer network including the shield.



For Ethernet connection, a separation device has to be used. For Example: 'Hardware options' *on page 19-4*

In this case the only way to operate the system safely is to use an isolated signal link with minimum air clearance and creepage distance of the isolation device in agreement with IEC60601 incl. national deviations. For computer networks there are media converters available which convert the electrical to optical signals. Please consider that this converter has

to comply with IEC xxx standards and is battery operated or connected to the isolated mains output of the Voluson® i. review: 'Main Module' *on page 19-8* .

Additionally the IEC60601 requires control measurement of leakage currents.

The system integrator (any person connecting the medical device to other devices) is responsible that the connections are safe.

IEC XXX Stands for standards such as: IEC 60601 for medical devices IEC 60950 for information technology equipment etc.

19.2 Important Notes: Connecting Auxiliary Equipment

The ultrasound system provides standard LAN network connectivity.

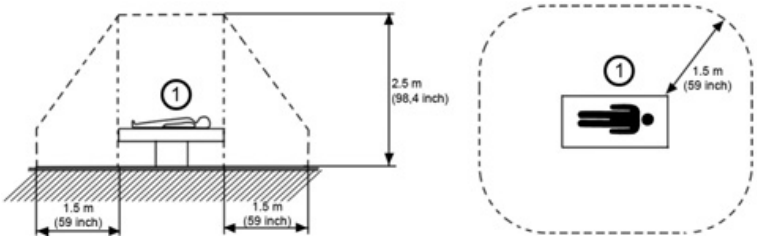
Possible loss of data during transfer via network from the ultrasound system.

For USB connections, a separation device has to be used.

The leakage current of the entire system including any / all auxiliary equipment must not exceed the limit values as per IEC 60601 resp. other valid national or international standards. All equipment must comply with relevant UL, CSA and IEC requirements.

Please observe that some printers may not be medical devices! If the Bluetooth Printer and/or Line Printers are no medical devices, they have to be located outside of the typical patient environment. Examples for typical patient environments can be found in standard IEC 60601 (see illustrations below).

Typical Patient Environment:



Auxiliary equipment with direct mains connection requires galvanic separation of the signal and / or control leads.

Do not connect a MULTIPLE SOCKET-OUTLET or extension cord to the ultrasound system.

There is an increased risk of electric shock due to increased leakage current when the secondary monitor is connected to AC mains directly via a wall outlet instead of utilizing the isolation transformer.

There is an increased risk of electric shock due to increased leakage current when connecting devices not explicitly recognized by the system manufacturer GE Healthcare Austria GmbH & Co OG to the ultrasound system (e.g. via the auxiliary power supply).

Only accessories explicitly recognized by the system manufacturer GE Healthcare Austria GmbH & Co OG may be used in connection with this ultrasound system.

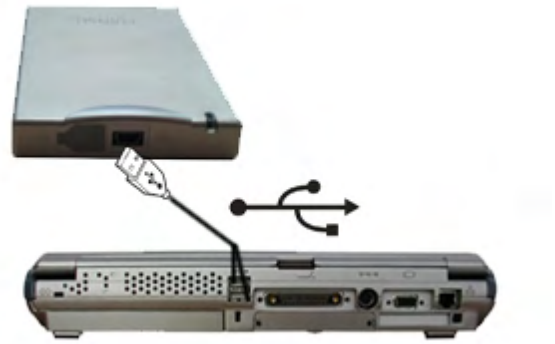
Only use cables delivered with the system or the accessories!

19.2.1 Hardware options

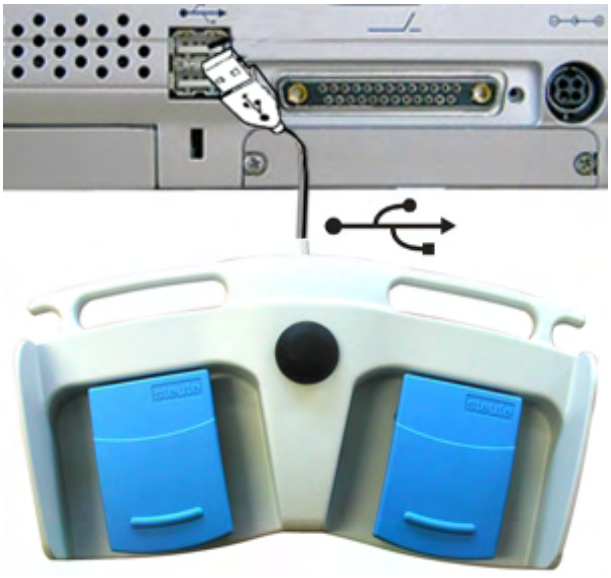
19.2.1.1 USB Stick



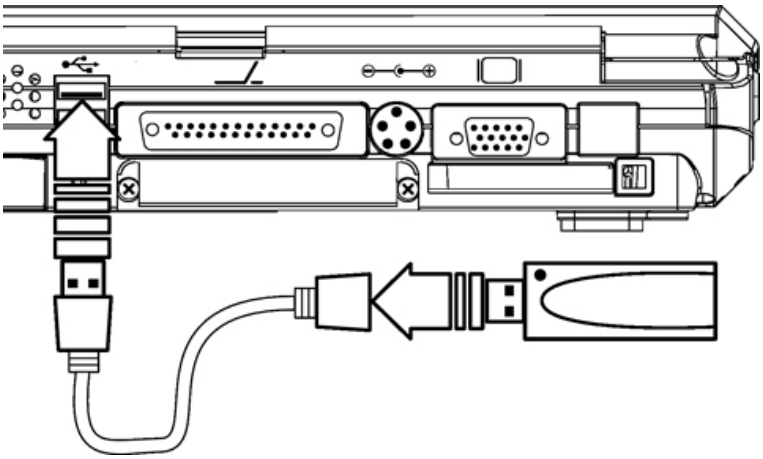
19.2.1.2 External Hard Disk Drive



19.2.1.3 Footswitch



19.2.1.4 Wireless LAN USB stick

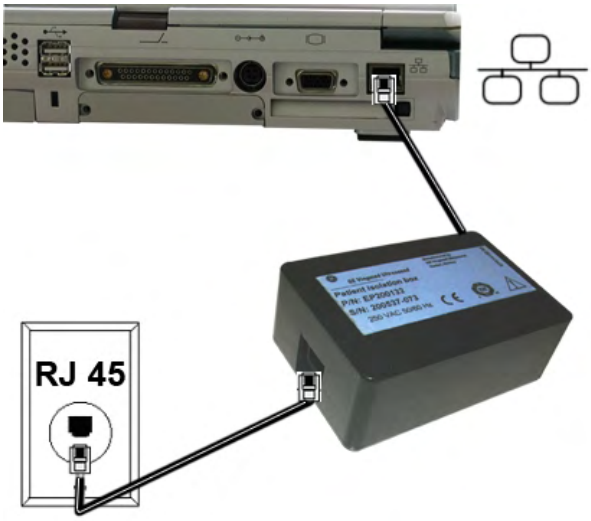


Use the provided extension device to connect the USB stick to the system.

19.2.1.5 Wireless LAN card



19.2.1.6 LAN Isolation box



19.2.1.7 External Monitor Kit

External 19'' Monitor & Isolating transformer



Note *Please see the kit's install manual for information regarding installation and connection.*

19.2.1.8 Isolating Transformer



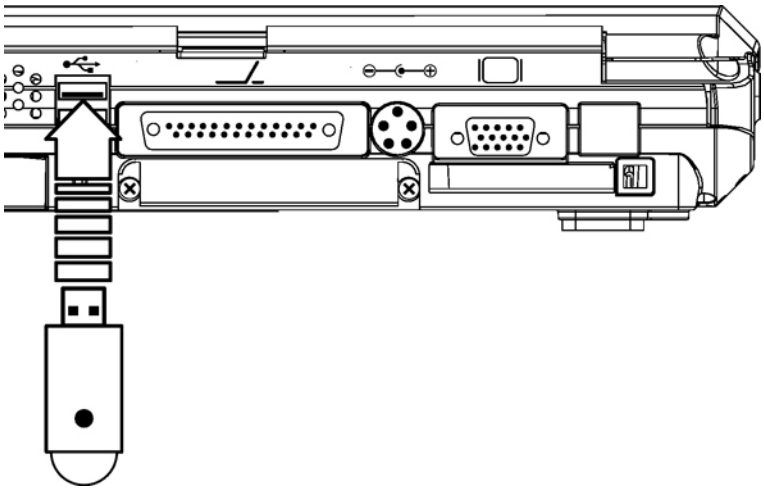
The isolating transformer facilitates the use of different types of external monitors.

Note *Please see the transformer's install manual for information regarding installation and connection.*

Always use the isolating transformer as power source for external VGA monitors connected to the Voluson® i.

19.2.2 Printers

19.2.2.1 Inkjet Printer - Bluetooth



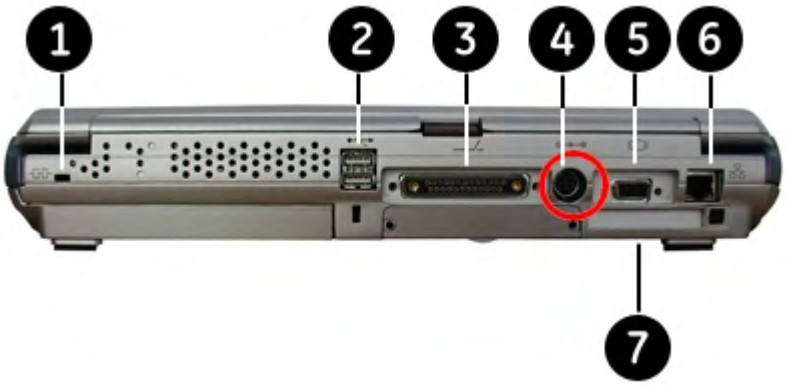
1. Connect the Bluetooth USB adapter to the Voluson® i's USB port as shown below.
2. Refer to the printer's manual for instructions on how to connect the Bluetooth unit to the printer.

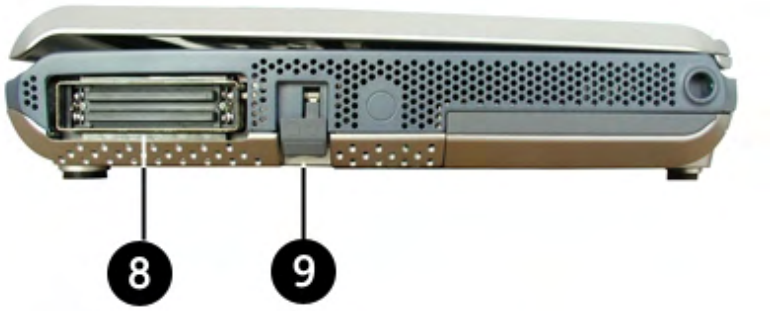
Please observe that the complete Bluetooth Printer Assembly has to be located outside of the patient environment (acc. IEC 60601-1 / UL 60601-1).

The printer may not be a medical device. The Bluetooth Adapter is also not a medical device. The Equipment meets the requirements of the IEC 60950 Standard.

19.3 Internal and External connections

19.3.1 Main Module





1. Kensington lock
2. 2x USB connectors
3. Docking connector
4. 'Power Supply (rear side)' *on page 19-8*
5. **VGA:** Connector for external color monitor
6. Ethernet LAN input/output
7. PCMCIA port (no longer available on all devices)
8. Probe connection
9. Probe locking lever

For more information see 'External inputs and outputs (Interfaces)' *on page 20-18.*

19.3.2 Power Supply (rear side)

Electricity inlet symbol

The Mains Adaptor

Mains Adaptor (symbolic picture)



Connect the mains adaptor to the electricity inlet of the Voluson® i and to a socket.

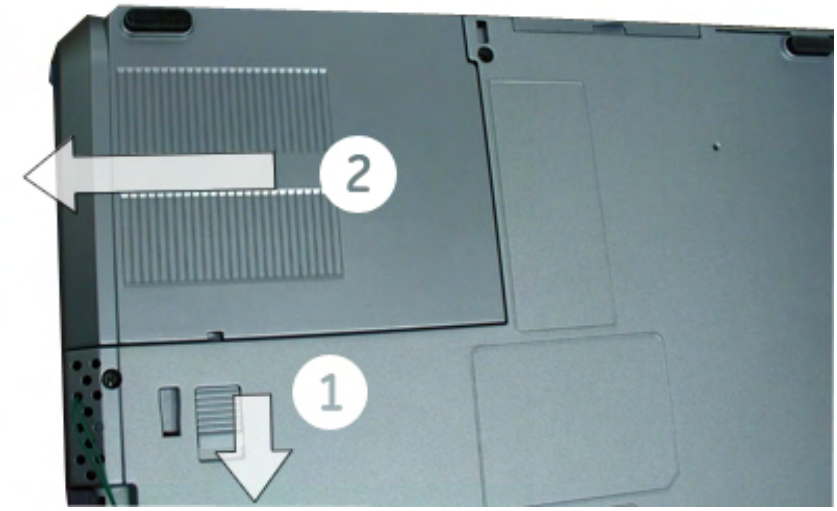
19.3.3 The Battery

Charging time: 2 hours at 3 Amp

Working time: 45 min. (battery only)

Removing the Battery

To remove the battery push the switch (1) and pull out the battery (2)



19.3.3.1 Battery Charger

A second battery is provided with the Voluson® i package.

19.4 Optional Items

19.4.1 Voluson® Station

Please refer to the *Voluson® Station Manual* or contact your local sales representative for further info.



19.4.2 Voluson® Dock Cart

Please refer to the *Voluson Dock Cart Manual* or contact your local sales representative for further info.



19.4.3 GoPack

For easy transportation and protection of the Voluson® i use the GoPack.



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Chapter 20

Technical Data / Information

Technical informations of power supply and mode performances.

Technical Data / Information

TYPE: Voluson® i

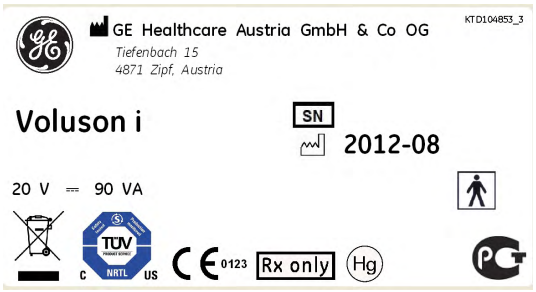
MODEL: Voluson® i

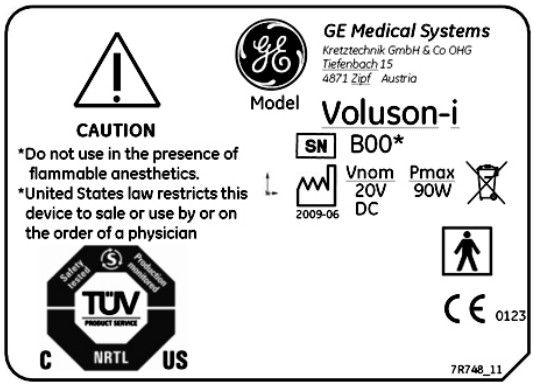
SERIAL NUMBER

Position: Bottom side of the Unit in the rating plate.

Rating plate

Example:





20.1 Basic Data

EMC (Electro-Magnetic Compatibility):	IEC* 60601-1-2
Emission:	CISPR11 Group 1 Class A IEC*61000-3-2 Power line harmonics IEC*61000-3-3 flicker emissions
Immunity:	IEC*61000-4-2: ± 2,4,8kV air discharge, ± 2,4,6kV contact discharge IEC*61000-4-3: 80 MHz - 2.5 GHz 3V/m IEC*61000-4-4: 2kV burst on power lines IEC*61000-4-4: 1kV burst on data lines, length above 3m IEC*61000-4-5: 2kV differential mode 1kV common mode IEC*61000-4-6: 150 kHz-80 MHz, 3Vrms (80% AM, 1kHz) IEC*61000-4-8: power frequency magnetic field IEC*61000-4-11: voltage dips
Electric safety:	IEC*60601-1 (IEC60601-1)

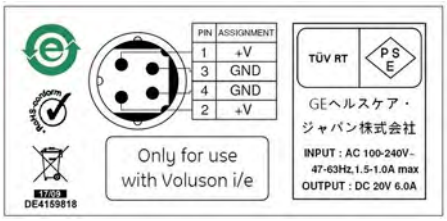
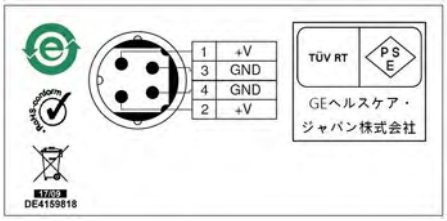
Mechanical safety:	IEC*60601-1 (IEC60601-1)
Thermal safety:	IEC*60601-1 (IEC60601-1)
Duty cycle:	100% on
Safety classification:	Internally powered, applied parts type BF according to IEC60601-1 including national deviations Information for service personnel: For safety test without AC-mains connection (battery operated): apply Class II limits for electrical safety test of Voluson ® i/e (e.g. NC (normal condition) 100µA touch-current acc. IEC60601-1) For safety test with AC-mains connection (by AC/DC adapter or Voluson Station/Cart): apply Class I limits for electrical safety test of Voluson® i/e (e.g. NC (normal condition) 500µA earth-leakage-current, 100µA enclosure leakage current, 100µA touch-current; SFC (single fault condition, like open PE or open L/N) 1000µA earth-leakage-current, 500µA enclosure leakage current, 500µA touch-current; acc. IEC60601-1); Do not perform ground continuity test on accessible conducting parts of the Voluson i/e. These parts are either isolated (floating) or connected to functional earth but not protective earth, i.e. the connection is not designed to withstand 25A ground continuity test and can damage the Voluson i/e. Aways observe national applicable regulations which might require different limits. For further information also consult the service manual.
Ambient temperature:	18ºC to 30ºC resp. 64ºF to 86ºF (operation temp. of instrument) -10˚C to 40˚C resp. 14˚F to 104˚F (storage and transport temp.)
Barometric pressure:	700 to 1060 hPa (operation condition) 700 to 1060 hPa (storage and transport condition)
Humidity:	30 to. 80% RH no condensation (operation condition) 0 to. 90% RH no condensation (storage and transport condition)
Humidity protection:	covered, no humidity protection
Dimensions:	391 x 378 x 70 mm [width x depth x height] 15.39 x 14.88 x 2.75 inches
Weight:	basic system (without accessories) approx. 5,6 kg (12.3 lb)
Maximum operating altitude:	4000m; depending on the properties of the connected electronic devices the maximum operating altitude is limited to the altitude stated in the corresponding user manual of the connected electronic device
Pollution degree:	2
Overvoltage category:	II
Material group:	IIIb
IPX 0 (system):	No protection against ingress of water.
IPX 8 (footswitch):	Protected against continual water submersion in under water conditions.
Total audible noise emission:	<55 dB/A

*) Including national deviations

20.2 Power supply

20.2.1 Labels

Examples:

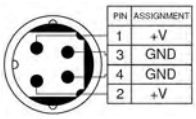
<table>
<tr><td rowspan="5"> 
</td><td>PIN</td><td>ASSIGNMENT</td></tr>
<tr><td>1</td><td>+V</td></tr>
<tr><td>3</td><td>GND</td></tr>
<tr><td>4</td><td>GND</td></tr>
<tr><td>2</td><td>+V</td></tr>
<tr><td colspan="2">Only for use with Voluson ® i/e</td></tr>
<tr><td colspan="2">Input: AC 100-240V~ 47-63Hz, 1.5-1.0A max</td></tr>
<tr><td colspan="2">Output: DC 20V 6.0A</td></tr>
<tr><td rowspan="5"> 
</td><td>1</td><td>+V</td></tr>
<tr><td>3</td><td>GND</td></tr>
<tr><td>4</td><td>GND</td></tr>
<tr><td>2</td><td>+V</td></tr>
</table>

<table>
<tr><td rowspan="9"> 
</td><td colspan="2">MAGIC POWER TECHNOLOGY</td></tr>
<tr><td colspan="2">POWER ADAPTER</td></tr>
<tr><td>MODEL:</td><td>MPM-X124-1</td></tr>
<tr><td>INPUT:</td><td>100-240 V AC 47-63 Hz, 1.5-1.0A max.</td></tr>
<tr><td>OUTPUT:</td><td>19-20 V DC 6.3-6.0A</td></tr>
<tr><td>P/N:</td><td>MPM-X124-2-717J</td></tr>
<tr><td colspan="2">20V DC 6A</td></tr>
<tr><td colspan="2">CAUTION:</td></tr>
<tr><td colspan="2">For use with Medical Equipment</td></tr>
<tr><td colspan="2">MADE IN TAIWAN</td></tr>
</table>

20.2.2 Data

Power supply adaptor:	Magic Power MPM-X124-1
AC Input:	100-240 VAC
DC Output:	20 VDC, 6A

20.2.2.1 Description of symbols on power supply

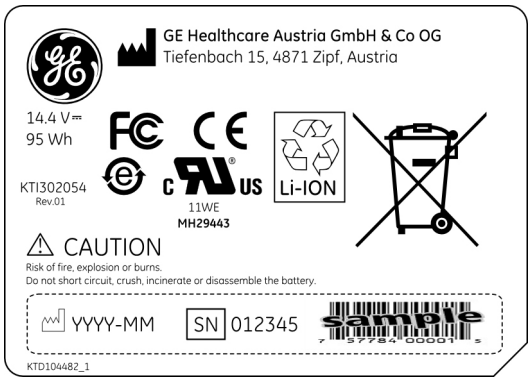


PIN	ASSIGNMENT	VOLTAGE
1	+V	20V
3	GND	0V
4	GND	0V
2	+V	20V

20.3 Battery

20.3.1 Label

The following rating plate is an example. It is attached to the external battery and shows the product's serial number, the name, address and trademark of the manufacturer, the voltage and capacity of the battery, labels regarding FCC, CE, China RoHS Labeling Standard, the UL Recognition Mark, Li-ION recycling and disposal as well as an important safety warning.



GE Healthcare Austria GmbH & Co OG Tiefenbach 15, 4871 Zipf, Austria
14.4V
95Wh
11WE MH29443
CAUTION Risk of fire, explosion or burns. Do not short circuit, crush, incinerate or disassemble the battery

20.3.2 Data

Battery:	12D137A1 Smart Battery including a rechargeable Lithium Ion battery and a Battery Management Module. The battery consists of (12) Lithium Ion rechargeable cells of 18650 size, assembled in a 4 series / 3 parallel (4S3P) configuration. Each cell has an average voltage of 3.6V and a typical capacity of 2.2Ah giving a battery pack of 14.4V and 6Ah typical.
Nominal Voltage:	Operation voltage is 14.4V
Capacity:	The initial capacity is 6.270mAh (based on a CV charge of 16.8V 50mV with a current limit of 3A and a 1320mA discharge to 11.0V @ 25C, within 1 hour of charge).
Initial Impedance:	fully charged battery < 180m; the positive and negative battery terminals at 1kHz at 20˚C (68˚F).
Environmental Conditions (Discharge/ Charge /Storage)	*For more information see* 'Basic Data' *on page 20-2.*

Charging:	The battery is capable of continuous charge at 16.8V, 3A across the entire operating temperature range. A dedicated level II or level III smart battery charger is required to charge the battery. Using this type of charger, the battery will request appropriate charging Voltage and Current from the smart battery charger. The FULLY_CHARGED bit in the BatteryStatus() will be set when the charging current tapers down under 220mA while charging at 16.8V. Fully charged the battery will be discharged in ca. 45 minutes.
Power supply adaptor:	AC Input: 100 – 250 VAC, 3-1.5 A, 47– 63 Hz. DC Output: 20 VDC, 6A

20.4 Transmitter

Frequency range:	Broadband system 1 to 15 MHz, automated adaptation to the probe used.
Control of acoustic output:	Range: 38 dB (1 – 100%)
Focusing:	selectable transmit focal length and focal depth
Sound field parameters:	The declaration of the sound field parameters acc. to IEC61157 and IEC60601-2-37 can be furnished by the manufacturer on request. Sound field limiting parameters on request.

20.5 Receiver

Frequency range:	Broadband system 1 to 15 MHz, automated adaptation to the probe used.
Focusing (with annular and multi-element):	Sub-pixel based digital dynamic focusing system: Accuracy of focus: +/- 3ns Sample-rate: 60.0 MHz
Processing-channels:	184.889 (probe dependent)
Receive-apodization:	yes
TGC:	manual, 90 dB control range by gain knob and slider-pots
Calculated DR (B+CFM)	239dB

20.6 Scan Converter

Video memory size:	1024 x 768 x 32 bit
Image memory:	4 MB
Gray scale values:	256 (8 bit)
Depth range:	max. 36 cm / 14.2 in (depends on used probe)
Image lines:	max. 768 (depends on used probe)
Scan angle:	max. 360º (depends on used probe)
Aspect ratio:	min. 0.25:1 to max. 40:1 (write 5:1, read factor 0.8 to 3.4), incremental magnification, no loss of resolution.

M Mode:	M mode search line positionable at each scan line M Mode depth range: same as 2D image M Mode full screen scroll time: 300 / 225 / 150 / 100 Pixels/sec. (50 Hz) in relation to monitor width 3.5 / 5.0 / 7.5 / 10 cm/s
2D/M Mode simultaneous:	yes (multi-element probes)

20.7 Cine Loop Memory

2D Mode	140 MB, up to 3000 2D images (depending on B-image size)
M-Mode	32 MB up to 20 min motion time (depending on sweep speed and depth)
Doppler Mode	32 MB up to 10 min motion time (depending on sweep speed)
2D Cine sequence:	manual: image by image automated: 25 to 200% of real-time rate, selection of start- and end image

20.8 Display Modes

2D scan:	Single, Dual, Quad, Trapezoid mode, Focus and Frequency Composite (FFC) CrossBeam Compound Resolution Imaging (XBeam-CRI) Coded Harmonic Imaging (HI), ß-View (Beta View); Speckle Reduction Imaging (SRI)
Additional modes:	XTD-View (optional)
3D/4D scan (optional):	For details see 'Volume Scan Module (optional)' *on page 20-14*.
M Mode:	2D / M (simultan) 2D / M / MCFM (triplex) 2D / M / MHDFlow (triplex)
Spectral Doppler Mode:	PW / CW: Details see 'Spectral-Doppler' *on page 20-16*
Color Doppler Mode(s):	C: 'Color-Doppler' *on page 20-16* PD: 'Power-Doppler' *on page 20-17* HDFlow: 'HD-Flow mode' *on page 20-18*
Image orientation:	left/right and up/down selectable

20.9 Signal / Image Processing

Persistence filter:	8 steps (pre)
Line filter:	3 steps (pre) off , low (12,5/75/12,5%) , high (25/50/25%)
Enhance:	6 steps (pre) 0 , 1 , 2 , 3 , 4, 5
Reject:	51 steps (pre) from 0 to 225
Gray scale dynamic:	9 basic curves and 3 User-defined (pre, post)

Dynamic:	12 different dynamic curves C1 – C12
Line Density:	3 steps (pre) low , norm , high
SRI	2 steps (high / low)
CRI	On/Off
FFC	On/Off

20.10 Data Entry

Patient name:	ID: 32 characters last: 32 characters First: 15 characters Middle: 15 characters
Accession #:	max 16 characters
Clinic/Doctor's name:	1 line with 31 characters
Sonographer:	up to 5 characters are displayed depending on font size
Date:	3 Types selectable: MM/DD/YYYY, DD/MM/YYYY, YYYY/MM/DD
Time:	2 Types selectable: 24 hours, 12 hours
Auto Text memory:	Max 400 terms with 12 characters, (40 terms for each application, 10 applications available)

20.11 User Program Memory

Program presets:	max. 5 applications per probe, each application max. 7 Program presets max. 35 settings per probe 10 default programs (one for each application, not programmable by the user)
3D/4D subprograms:	max. 5 applications per probe, each application max. 7 Sub Programs; max. 35 settings per probe 10 default programs (one for each application, not programmable by the user)

20.12 Generic Measurements and Calculations

20.12.1 Generic Measurements

2D Mode and 3D:	Distance:	Distance (Point to Point), Distance (Line to Line), 2D Trace (Trace Length & Point), Stenosis (% Dist)
	Area/Circumference:	Ellipse, Trace (Line & Point), Area (2 Dist) Stenosis (% Area)
	Volume:	1 Distance, 1 Ellipse, 1 Dist. + Ellipse, 3 Distances, Multiplane - planimetric volume (3D only)
	Angle:	Angle (3 Point), Angle (2 Line)
M Mode:		Distance, Slope, Time, HR (Heart Rate), Stenosis (% Dist)
Doppler Mode:	Auto & Manual Trace: (dependent on application)	PS (Peak Systole), ED (End Diastole), PD (Peak Diastole), MD (Mid Diastole), PS/ED (Ratio), PI (Pulsatility Index), RI (Resistance Index), TAmean (Time avg. mean. Velocity) VTI (Velocity TimeIntegral), Heart Rate, Vol.Flow
	Single Measurements:	Velocity, Acceleration, RI, PI, PS/ED, Time, HR

20.12.2 Calculations

Abdomen:	Liver, Gallbladder, Pancreas, Spleen, Left/Right Kidney, Left/Right Renal Artery, Aorta (Proximal, Mid, Distal), Portal Vein, Vessel; Bladder Volume; all included in Summary Reports	
Small Parts: Default	Left/Right Thyroid, Left/Right Testicle, Vessel; all included in Summary Reports	
Small Parts Breast:	Left/Right Lesions 1 -5; all included in Summary Reports	
Obstetrics:	2D:	Fetal Biometry, Early Gestation, Fetal Long Bones, Fetal Cranium, AFI, Uterus, Left/Right Ovary, Left/Right Uterine, Umbilical Vein, Fract Limb Vol, NT method: auto/manual
	M:	Generic, FHR (FHR, Atrial FHR)
	Doppler:	Ductus Art., Ductus Ven.,Ao, Carotid, MCA, Celiac Artery, Superior Mesenteric Artery, Umbilical Art., Umbilical Vein, Uterine Art., Umbilical Vein, FHR Gestational Age Calculation, Gestational Growth Calculation, Fetal Weight (FW) Estimation, Fetal Trend Graph, Multi-Gestational Calculation & Fetal Compare, Calculation and Ratios, Fetal Qualitative Description (Anatomical survey), Fetal Environmental Description (Biophysical profile);
		all included in Summary Reports

Obstetrics: Fetal Echo	2D:	4-Chamber-view, Thorax, Outflow Tract, Aortic arch, Venous, LVOT, RVOT
	M:	4-Chamber-view, Outflow Tract, FHR (FHR, Atrial FHR)
	Doppler:	Tricuspid valve, Mitral Valve, Aortic Valve, Main Pulmonary Artery, Pulmonary Valve, Aorta, Ductus Art., Umbilical Vein, Ductus Ven., FHR, LVOT, RVOT, Pulmonary Veins; TEI Index, Rt/Lt-UMA, IVC; Carotid
		all included in Summary Reports
Obstetrics: Z-Scores	Calculation of Z-Scores for: Long Axis, Aortic Arch, Short Axis, Obl. Short Axis, 4 Chamber; all included in Summary Reports	
Cardiology:	2D Mode:	LV Simpson (Single & Bi-Plane), Volume (Area Length), LV-Mass (Epi & Endo Area, LV Length), LV (RVD, IVS, LVD, LVPW), LVOT Diameter, RVOT Diameter, MV (Dist A, Dist B, Area), TV (Diameter), AV/LA (Aortic Valve/LeftAtrium), PV (Diameter)
	D Mode:	MV (Mitral Valve), AV (Aortic Valve), TV (Tricuspid Valve), PV (Pulmonary Valve), LVOT & RVOT (Left & Right Ventricle Outflow Tract), Pulmonic Veins, PAP (Pulmonary Artery Pressure measurement), HR (Heart Rate) , C Mode: PISA; TEI-Index
	M Mode:	LV (IVS, LVD, LVPW, RVD), AV/LA (Ao Root Diam, LA Diam, AV Cusp Sep., Ao Root Ampl.), MV (D-E, E-F Slope, A-C Interval, EPSS), HR (Heart Rate), HR (HR, Atrial HR)
	Others:	Diast. Vol.(Bi), Syst.Vol.(Bi), Stroke Volume, Volume Flow, Cardiac Output, Ejection Fraction, Fractional Fract. Shortening, Myocardial Thickness, LA/Ao Ratio, E/A Peak , Peak Gradient Acceleration, Mean Gradient, Mean Gradient Acceleration, VTI, TVA, PG, PHT, MVA, AVA, ERO,CVP (Cardio Vascular Profile) Score etc.
	all included in Summary Reports	
Urology:	Bladder, Prostate, Left/Right Testicle, Left/Right Kidney, Left/Right Renal Artery, Left/Right Dorsal Penile Artery, Vessel;all included in Summary Reports incl. PSAD, PPSA(1), PPSA(2) calculation	

Vascular:	Carotid:	CCA, ECA, ICA, Bulb, Vertebral, Subclav., Vessel
	UEA:	SUBC A, AXILL A, BRACH A, RADIAL A, ULNAR A, GRAFT, Palm A, INNOM A,
	UEV:	JUGUL, INNOM V, SUBC V, AXILL, CEPH, BASIL, BRACH, MCUB, RADIAL, ULNAR,
	LEA:	COM ILIAC A, EXT ILIAC A, INT ILIAC A, COM FEM A, DEEP FEM A, SUP FEM A, POPL A, ANT TIB A, POST TIB A, PERON A, DORS PED A, GRAFT, PROF A
	LEV:	IVC, COM ILIAC V, EXT ILIAC Vein, COM FEM, GSAPH V, FEM V, DEEP FEM V, POPLIT V, L SAPH V, ANT TIB V, POST TIB V, PERON V, PROF V
	Renal:	RENAL A, M RENAL A, RENAL V, SEGM A, INTERLO A, ARC A
	TCD:	ACA, MCA, PCA, Basilar, A Comb.A, P Comb.A, Vertebral, Vessel, Basilaris
	all included in Summary Reports	
Gynecology:	Uterus, Right/Left Ovary, Right/Left Follicle, Fibroid, Endometrial thickness (Dist., Double Dist.), Cervix Length, Left/Right Ovarian Artery, Left/Right Uterine Artery, Vessels, Pelvic Floor; FHR; all included in Summary Reports	
Pediatrics:	Left/Right Hip Joint; Pericallosal Artery, included in Summary Report	
Neurology:	Left/Right ACA (Anterior Cerebral Artery), Left/Right MCA (Middle Cerebral Artery), Left/Right PCA (Posterior Cerebral Artery), Basilar Artery, A-Com. A (Anterior Com. Artery), P-Com. A (Posterior Com. Artery), Left/Right CCA (Common Carotid Artery), Left/Right ICA (Internal Carotid Artery), Left/Right Vertebral Artery, Vessels; all included in Summary Reports	
MSK:	none	

20.12.3 OB Tables

“Age” Tables:	AC: ASUM, CFEF, Chitty, Hadlock_82, Hadlock_84, Hansmann, Hobbins, Jeanty, JSUM, Kurmanavicius, Merz, Nicolaides, Shinozuka, Siriraj, Tokyo
	AD: Persson
	APAD: Merz
	APTD: Hansmann
	APTDxTTD: Shinozuka, Tokyo
	BOD: Jeanty
	BPD: ASUM, ASUM (old), Campbell, CFEF, Chitty (outer-outer) (outer-inner), Hadlock_82, Hadlock_84, Hansmann, Hobbins, Jeanty, Johnsen, JSUM, Kurmanavicius, Kurtz, McLennan, Merz, Nicolaides, Persson, OSAKA, Rempen, Sabbagha, Shinozuka, Siriraj, Tokyo, Verburg (outer-outer)
	CLAV: YARKONI
	CRL: ASUM, ASUM(old), DAYA, Hadlock, Hansmann, JSUM, McLennan, Nelson, Persson, OSAKA, Rempen, Robinson, Robinson_BMUS, Shinozuka, Tokyo, Verburg
	FL: ASUM, ASUM_OLD, CFEF, Chitty, Hadlock_82, Hadlock_84, Hansmann, Hobbins, Hohler, Jeanty, Johnsen, JSUM, Kurmanavicius, Persson, Merz, Nicolaides, O´Brien, OSAKA, Shinozuka, Siriraj, Tokyo, WARDA
	FTA: OSAKA
	FIB: Jeanty
	GS: Hansmann, Hellman, Holländer, Rempen, Tokyo
	HC: ASUM, CFEF, Chitty, Hadlock_82, Hadlock_84, Hansmann, Jeanty, Johnsen, Kurmanavicius, Merz, Nicolaides, Siriraj
	HL: ASUM, Hobbins, Jeanty, Merz, OSAKA
	LV: Tokyo
	MAD: EIK-NES, Kurmanavicius
	OFD: ASUM, Chitty, Hansmann, Jeanty, Kurmanavicius, Merz, Nicolaides
	RAD: Jeanty, Merz
	TIB: Jeanty, Merz
	TAD: CFEF, Merz,
	TCD: Chitty, Goldstein, HILL, Hobbins, Nicolaides,
	TTD: Hansmann
	ULNA: Jeanty, Merz

“Growth” Tables:	AC: ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, JSUM, Johnsen Kurmanavicius, Lessoway, Merz, Nicolaides, Shinozuka, Siriraj, Tokyo, Verburg
	AD: Persson
	AFI: Moore
	Aorta Vmax: Rizzo
	APAD: Merz
	APTD: Hansmann
	APTDxTTD: Shinozuka, Tokyo
	BOD: Jeanty
	BPD: ASUM, Campbell, CFEF, Chitty, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, JSUM, Kurmanavicius, Lessoway, McLennan, Merz, Nicolaides, Persson, OSAKA, Sabbagha, Shinozuka, Siriraj, Tokyo, Verburg
	CLAV: YARKONI
	CM: Nicolaides
	CRL: ASUM, Hadlock, Hansmann, JSUM, McLennan, Persson, OSAKA, Robinson, Shinozuka, Tokyo
	DV PI, DV PLI, DV PVIV, DV S/a: Baschat
	FL: ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, Johnsen, JSUM, Kurmanavicius, Lessoway, Persson, Merz, Nicolaides, O ´Brien, OSAKA, Shinozuka, Siriraj, Tokyo, Verburg, WARDA
	FTA: OSAKA
	FIB: Chitty, Jeanty, Siriraj
	Foot: Chitty
	GS: Hellman, Nyberg, Rempen, Tokyo
	HC: ASUM, CFEF, Chitty, Hadlock, Hansmann, Jacot-Guillarmod, Jeanty, Johnsen Kurmanavicius, Lessoway, Merz, Nicolaides, Siriraj, Verburg
	HL: ASUM, Chitty, Jeanty, Merz, OSAKA, Siriraj
	Lung Area Left/Right: Peralta
	LV: Tokyo
	MAD: EIK-NES, Kurmanavicius
	MCA PI, RI: JSUM, Bahlman
	MCA PV: Mari
	MV E/A: HARADA
	NBL: BUNDUKI, SONEK
	OFD: ASUM, Chitty, Hansmann, Jeanty, Kurmanavicius, Merz, Nicolaides
	MainPA Vmax: Rizzo
	RAD: Chitty, Jeanty, Merz, Siriraj
	TAD: CFEF, JACOT-GUILLARMOD, Merz,
	TC: Chitkara

	TCD: Goldstein, HILL, JACOT-GUILLARMOD, Nicolaides, Verburg
	TIB: Chitty, Jeanty, Merz, Siriraj
	TTD: Hansmann
	TV E/A: HARADA
	ULNA: Chitty, Jeanty, Merz, Siriraj
	UmbArt PI: JSUM, Merz
	UmbArt RI: JSUM, Merz, Kurmanavicius
	UtArt PI: Merz
	UtArt RI: Merz
Fetal Weight Estimation (EFW)	Campbell (AC), Hadlock (AC, BPD), Hadlock 1 (AC, FL), Hadlock 2 (BPD, AC, FL), Hadlock 3 (HC, AC, FL), Hadlock 4 (BPD, HC, AC, FL), Hansmann (BPD, TTD), Merz (AC, BPD), Osaka (BPD, FTA, FL), Persson (BPD, MAD, FL), Persson 2, Schild (HC, AC, FL), Shepard (AC, BPD), Shinozuka 1 (BPD, APTD, TTD, FL), Shinozuka 2 (BPD, FL, AC), Shinozuka 3 (BPD, APTD, TTD, LV), Tokyo (BPD, APTD, TTD, FL),
Gestational Age by EFW	Hadlock, JSUM 2001, Osaka, Shinozuka, Tokyo
Fetal Weight Growth FWg	Brenner, Bourgogne, Doubilet, Hadlock, Hansmann, Hansmann (86), Hobbins/ Persutte, Johnsen, Jsum 2001, Kramer, Persson, Osaka, Shinozuka, Tokyo, Williams, Yarkoni, Ananth
Fetal Ratios	CI (BPD/OFD) (Hadlock)
	FL/AC (Hadlock)
	FL/BPD (Hohler)
	FL/HC (Hadlock)
	HC/AC (Campbell)
	Va/Hem (Nicolaides)
	Va/Hem (Hansmann)
	Vp/Hem (Nicolaides)
	LHR (Peralta)
	LTR
	CVR (Peranteau)

20.13 Volume Scan Module (optional)

Vol. scan size:	max. 64 MB for gray volumes; max. 90 MB for color volumes; The required memory space depends on scan parameters (VOL-box size and quality (low, mid1, mid2, high1, high2, max). typ.: 1-5 MB
Lines/2D-image:	max. 768 (typ. 50 to 250)
2D-images/volume:	max. 1024 (typ. 50 to 250)

VOL-Frames/sec.:	max. 25 (typ. 4-10) The frame rate depends on scan parameters: VOL-Box size, quality and probe.
4D Volume Cine:	up to 128 volumes
Display of sectional plane images:	synchronous with control setting, arbitrary movement in volume, monitored position in volume.
Rotation:	360º, 1º increments (X-, Y- and Z-axis)
Magnification:	adjustable from 0.25 to a factor of 4.00
Acquisition Modes:	• 3D Static: B-Mode (incl. CRI) • 3D Angio: 3D/PD (B/Power Doppler) • 3D Color: 3D/CFM (B/Color Flow Mode) • 3D HDFlow: 3D/HDFlow (B/HDFlow) • 4D Real Time • 4D Biopsy • VCI-A, VCI-C • STIC: Fetal Cardio Incl. CRI) • STIC Angio: B/Power Doppler • STIC CFM: B/Color Doppler • STIC HD-FLow: B/HD-Flow
Visualization Modes:	• 3D Rendering (diverse surface and intensity projection modes) • Sectional Planes (3 Section planes perpendicular to each other) • Niche (3D Static only) • VOCAL: manual segmentation tool (3D Static only) & Threshold Volume: measure volume below and above a threshold • VCI Static: Apply VCI to static 3D data sets • T.U.I: - Tomographic Ultrasound Imaging (overview image + parallel slices) • SonoVCAD *heart* • SonoAVC *follicle* • VCAD *labor*
Render Mode:	Mix Mode of two Render Modes (calculation and display): • Surface texture, Surface Smooth • max, min and X-ray (average intensity projection) • Gradient • Glass Body • Inversion Calculation time depends on rendering box size.
Display graphics:	• rotation axis, center point; • ROI box, 3D Frame; • temporary display of onscreen controls (rotation, translation)

20.14 Spectral-Doppler

Working Modes:	Pulsed Wave Doppler (Single Gate)
Transmit frequencies:	PW-Doppler: 2-15 MHz
Pulse Repetition Frequency (PRF):	PW-Doppler: 1.3 ...22.1 kHz
Sample Volume (Doppler Gate):	Length: 0.7, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15 mm Position: 5 mm to B-scan end Angle correction: - 85º ... 0º ... + 85º
Power control range:	32dB (1 – 100%)
GAIN range:	+ 15 ... - 25dB (PW)
WMF (wall motion filter) PW:	70...500Hz
Zero line shift:	± PRF/2, ± 8 steps
Spectrum Analyzer:	FFT (Fast Fourier Transformation) max. 256 channels, 255 amplitude levels
PW sweep speeds:	Simplex (2.2, 3.3, 4.4, 6.6, 10 ms) Duplex/Triplex (4.4, 6.6, 10 ms)
Review (memory times):	> 60 s (32 MB)
Measurable flow velocities:	Pulsed wave: 1cm/s - 8m/s (a = 0º, 2.0MHz, max. zero shift) 1cm/s - 16m/s (a = 60º, 2.0MHz, max. zero shift)
Signal processing:	Dynamic range: 15 steps (10 to 40)
Scale display:	Vert.: kHz, cm/s, m/s (selectable) Hor.: 1s marker (big), ½ s marker (small)
Image formats:	2D/D (three different formats small, mid, large)
Display formats:	2D/D (duplex, simultaneous); 2D+CFM/D, 2D+HD-Flow/D, 2D +PD/D (duplex) 2D/D/CFM, 2D/D/HD-Flow, 2D/D/PD (triplex)
Audio mode:	Stereo (both directions separately in both channels)
Audio Volume	Adjustable, control knobs

20.15 Color-Doppler

CFM / MCFM Mode:	Color flow imaging is possible with curved array, linear array and phased array probes.
Display modes:	2D/CFM (Single, Dual, Quad); Simultaneous dual mode: 2D+2D/ CFM;Triplex mode: 2D/CFM/D, 2D/M/MCFM;3D/CFM (optional);
Color coding steps:	65536 color steps
Depth range:	axial: 0 to B scan range lateral: 0 to B scan range
Baseline shift:	17 steps (independent from spectral Doppler)
Inversion of color direction:	yes
Wall Motion Filter:	7 steps (low1, low2, mid1, mid2, high1, high2, max; 8 - 3000 Hz)

Smoothing Filter:	12 steps rising time 12 steps falling time
Gain control:	+15dB – -15dB, 0.2dB steps (30dB)
Line Density (color line density):	10 steps
Ensemble (color shots per line):	CFM: 7 to 31 MCFM: 8 to 16
Flow Resolution:	4 steps (1, 2, 3 and 4)
Pulse repetition frequency:	CFM: 150 Hz to 13 kHz MCFM: 150 Hz to 11 kHz
Color Map:	8 different color codes for each probe
Frequency range:	1 to 15 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Balance:	from 25 to 255
Max. meas. velocity:	3.46 m/sec.
Min. meas. velocity:	0.2 cm/sec.
Display modes:	V-T (velocity + turbulence) V (velocity) V-P (velocity + power) T (turbulence) P-T (power + turbulence)
Scale:	kHz, cm/s, m/s
Automatic moving tissue suppression:	yes

20.16 Power-Doppler

PD Mode:	Power-Doppler imaging is possible with curved array, linear array and phased array probes.
Display modes:	2D/PD (Single, Dual, Quad); Simultaneous dual mode: 2D+2D/ PD;Triplex mode: 2D/PD/PW;3D/PD (optional);
PD coding steps:	256 color steps
PD window size:	lateral: maximum to minimum B mode scan angle axial: B-scan range
Display mode:	P (power)
Wall motion Filter:	7 steps (low1, low2, mid1, mid2, high1, high2, max; 8 - 3000 Hz)
Smoothing Filter:	rising edge: 12 steps; falling edge: 12 steps
Gain control:	+15dB to -15dB, 0.2dB steps (30dB)
PD Ensemble:	7 to 31
PD Line Density:	10 steps
Pulse repetition frequency:	150 Hz to 13kHz
PD Map:	8 different color codes for each probe

Frequency range:	1 to 15 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Flow Resolution:	4 steps (1, 2, 3 and 4)
Balance:	from 25 to 225 in 41 steps
Artifact suppression:	yes

20.17 HD-Flow mode

HD-Flow:	Bi-directional angio-Doppler-imaging is possible with curved array and phased array probes.
Display modes:	2D/HD-Flow (Single, Dual, Quad); Simultaneous dual mode: 2D +2D/HD-Flow; Triplex mode: 2D/HD-Flow/D; 2D/M/MHD-Flow 3D/HD-Flow (optional)
HD-Flow coding steps:	256 color steps
HD-Flow window size:	lateral: maximum to minimum 2D mode scan angle axial: B-scan range
Display mode:	P (power)
Wall motion Filter:	7 steps (low1, low2, mid1, mid2, high1, high2, max; 8 - 3000 Hz)
Smoothing Filter:	rising edge: 12 steps; falling edge: 12 steps
Gain control:	+15dB to -15dB, 0.2dB steps
HD-Flow Ensemble:	7 to 31
HD-Flow Line Density:	10 steps
Pulse repetition frequency:	150 Hz to 20.5kHz
HD-Flow Map:	8 different color codes for each probe
Frequency range:	1 to 15 MHz depending on the probe, adjustable in 3 steps (low, mid, high)
Flow Resolution:	4 steps (1, 2, 3 and 4)
Balance:	from 25 to 225
Artifact suppression:	yes

20.18 External inputs and outputs (Interfaces)

VGA out:	Red: $0.7V_{ss}/75\Omega$ Green: $0.7V_{ss}/75\Omega$ Blue: $0.7_{ss}/75\Omega$
Separate positive H/V-Sync:	TTL-level
Network (RJ45):	Ethernet, IEC802-2, IEC802-3 Software: DICOM 3.0 standard
USB (2x):	Standard: 2.0
DC Power Input:	20 V DC

Anti-theft lock	
PCMCIA slot	
Docking station (cart)	

20.19 Monitor

Flat Panel Monitor:	15"' high-resolution LCD Monitor
Resolution:	1024 x 768 pixel
Vertical:	60Hz
Safety classification:	IEC60601-1 / EN60601-1

20.20 Drives

CD/DVD + R/RW Drive (optional):

Supported Media (Read & Write)	DVD-ROM, DVD+R, DVD+RW CD-ROM, CD-R, CD-RW
Min. Read Speed	DVD-ROM 8x, CD-ROM 24x
Write Speed:	DVD+R, DVD+RW: max 8x CD-R, CD-RW: max 24x
Access Time:	DVD: 140ms ; CD: 120ms

20.21 Voluson Dock Cart

Please refer to the Technical Data chapter of the *Voluson Dock Cart Manual.*

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Chapter 21

Glossary- Abbreviations

Description of abbreviations, sorted alphabetically

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A

Abbreviation	Designation
A2C Dias.	2 chamber Diastole
A2C Syst.	2 chamber Systole
% StA	Area Reduction in%
% StD	Distance Reduction in%
A-Com. A	Anterior Common Artery
Aborta	Number of abortions
AC	Abdominal Circumference
ACA	Anterior Cerebral Artery
ACC	Acceleration
AD	Abdominal diameter
AFI	Amniotic Fluid Index
ANT TIB A	Anterior Tibial Artery
ANT TIB V	Anterior Tibial Vein
Ao Cusp	Aortic Valve Cusp Separation
Ao Root Ampl	Aortic Root Amplitude
Ao Root Diam	Aortic Root Diameter
Aorta Vmax	Maximum Flow Velocity Aorta
Ao/LA	Aorta/Left Atrium
AV	Aortic Valve
APAD	Anterior/Posterior Abdominal Diameter
APTD	Anterior/Posterior Thoracic Diameter
APTDxTTD	APTD x Trunc Transverse Diameter
ARC A	Arcuate Artery (Renal Vascular Measurement)
ASUM	Australian Society for Ultrasound in Medicine
AUA	Average Ultrasound Age
AVA	Aortic Valve Area
A Vol	Arm volume
AXILL	lat. Axilla
AXILL A	Axillary Artery

B

Abbreviation	Designation
BASIL	lat. Basilaris
Basilaris	Basilar engl. = lat. Basilaris
Basilar	lat. Basilaris

Abbreviation	Designation
B-Flow	B-Flow
BOD	Binocular Distance
BPD	Biparietal Diameter
BRACH	lat. Brachialis
BRACH A	Brachial Artery
BSA	Body Surface Area
Bulb	lat. Bulbus = engl carotid (artery) bulb

C

Abbreviation	Designation
CCA	Common Carotid Artery
CE	Coded Excitation
CEPH	lat. Cephalica = engl. Cephalic
CFEF	Collège Français d'Echographie Foetale
CFM	Color Flow Mode
CGA	Calculated Gestational Age
CI	Cephalic Index
CLAV	Clavicle
CM	Cisterna Magna
CO	Cardiac Output
COM FEM A	Common femoral artery
COM FEM	common femoral
COM ILIAC A	Common iliac artery
COM ILIAC V	Common iliac vein
CRL	Crown-Rump Length
CSA	Cross sectional area
C.S.P	Cavum Septum Pellucidum
CUA	Composite Ultrasound Age
CW	Continuous Wave Doppler

D

Abbreviation	Designation
d	Diastole (diastolic)
DEC	Deceleration
DEEP FEM A	deep femoral artery
DEEP FEM V	deep femoral vein
Din	Inner (reduced) distance

Abbreviation	Designation
Dout	Outer (original) distance
DOB	Day of Birth
DOC	Day of Conception
Dor. PenA	Dorsal Penile Artery
DORS PED A	lat. arteria dorsalis pedis = engl. Dorsal pedis artery
Dur	Duration
DV PI	Ductus Venosus PI (=Pulsatility Index)
DV PLI	Ductus venosus PLI (=preload Index)
DV PVIV	Ductus venosus PVIV (=peak velocity index vein)
DV S/a	Ductus venosus S/a ratio

E

Abbreviation	Designation
ECA	External Carotid Artery
Ectopic	Number of ectopic pregnancies.
ED	End Diastole (see also: Vd)
EDD	Estimated Day of Delivery
EDV	End Diastolic Velocity
EF	Ejection Fraction
EFW	Estimated Fetal Weight
Endo Area	Endocardial Area
Epi Area	Epicardial Area
Epi Length	Epicardial Lenght
EPSS	E-Point-to-Septum Separation
ERO	Effective Regurgitant Orifice
EUM	Electronic User Manual
Exp. Ovul.	Expected Ovulation
EXT ILIAC A	External iliac artery
EXT ILIAC V	External iliac vein

F

Abbreviation	Designation
FEM V	Femoral Vein
FFC	Focus and Frequency Composite
FHR	Fetal Heart Rate
FIB	Fibula Length
FL	Femur Length

Abbreviation	Designation
FS	Fractional shortening
FTA	Fetal Trunk Area
FW	Fetal Weight

G

Abbreviation	Designation
GA	Gestational Age
Gmean	Mean Gradient
GP	Growth Percentile
Gpeak	Peak Gradient
Gravida	Number of pregnancies
GRAFT	vacular implant
GS	Gestational Sac
GSAPH V	Great saphenous vein

H

Abbreviation	Designation
HC	Head Circumference
HD-Flow	High Definition Flow
HEM	Hemisphere
HI	Harmonic Imaging
HR	Heart Rate
HSVa	Hemisphere Ventricle anterior
HSVp	Hemisphere Ventricle posterior
HL	Humerus Length

I

Abbreviation	Designation
ICA	Internal Carotid Artery
INNOM A	innominate artery
INNOM V	innominate vein
INT ILIAC A	internial iliac artery
INTERLO A	Interlobular arteries
IOD	Inner Ocular Distance
IVRT	Isovolumetric Relaxation Time
IVS	Inter-ventricular Septum

J

Abbreviation	Designation
JSUM	Japan society of ultrasound in medicine
JUGUL	lat. Jugularis / engl. jugular

L

Abbreviation	Designation
LA Diam	Left Atrial Diameter
LEA	Lower extremity atery
LEV	Lower extremity vein
LMP	Last Menstrual Period
L SAPH V	lower saphenous vein
LV	Length of Vertebra
LV	Left Ventricle
LV Vol.	Left Ventricle Volume
LVA	Left Ventricular Area
LVD	Left Ventricle Diameter
LVM	Left Ventricular Mass
LVOT	Left Ventricle Outflow Tract
LVPW	Left Ventricle Posterior Wall

M

Abbreviation	Designation
M&A	Measurement & Analysis
MAD	Middle Abdominal Diameter
MainPA Vmax	Main pulmonary artery Vmax
MCA	Middle Cephalic Artery
MCA PI	Middle Cephalic Artery + Pulsatility Index
MCA PV	Middle Cephalic Artery + PV = PS peak systolic
MCFM	M Mode + Color Flow Mode
MCUB	median cubital
MD	“Mid” Diastole (minimum velocity)(see also: Vd and Vmin)
MI	Mechanical Index
MnG	Mean Pressure Gradient
M RENAL A	main renal artery
MPPS	Modality Performed Procedure Step
MV	Mitral Valve
MVA	Mitral Valve Area

N

Abbreviation	Designation
NBL	Nasal Bone Length
NF	Neck Fold
NT	Nuchal Translucency

O

Abbreviation	Designation
OFD	Occipito Frontal Diameter
OOD	Outer Ocular Distance
OTI	Optimized Tissue Imaging

P

Abbreviation	Designation
P-Com. A	Posterior Common Artery
Palm A	palmar artery
PAP	Pulmonary Artery Pressure
Para	Number of live births
PCA	Posterior Cerebral Artery
PERON A	peroneal artery
PERON V	peroneal vein
PD	Power Doppler
PG	Pressure Gradient
PHT	Pressure Half Time
PI	Pulsatility Index
PISA	Proximal Isovelocity Surface Area
PPSA	Predicted PSA (see also: PSA)
POPL A	popliteal artery
POPLIT V	popliteal vein
POST TIB A	posterior tibial artery
POST TIB V	posterior tibial vein
PRF	Pulse Repetition Frequency
PROF A	profunda femoris artery
PROF V	profunda femoris vein
PS	Peak Systole (see also: Vmax)
PSA	Prostate-specific antigen
PSV	Peak Systolic Velocity
PV	Pulmonary Valve

Abbreviation	Designation
PVA	Pulmonary Valve Area
PW	Pulsed Wave Doppler

R

Abbreviation	Designation
RAD	Radius Length
RADIAL A	radial artery
Regurg	Regurgitation
Renal	renal
RENAL A	renal artery
RENAL V	renal vein
RI	Resistivity Index
ROI	Region of Interest
RT	Real Time
RVD	Right Ventricle Diameter
RVOT	Right Ventricle Outflow Tract

S

Abbreviation	Designation
s	Systole (systolic)
S/D	Systolic/Diastolic Ratio
SD	Standard Deviation
SEGM A	segmental artery
SL	Spine Length
SRI	Speckle Reduction Imaging
STIC	Spatio-Temporal Image Correlation
SUBC A	subclavian artery
SUBC V	subclavian vein
Subclav	subclavian
SUP FEM A	superior femoral artery
SV	Stroke Volume

T

Abbreviation	Designation
TAD	Transverse Abdominal Diameter
TAmax	Time Averaged maximum velocity
TAmean	Time Averaged mean velocity

Abbreviation	Designation
TCD	Transverse Cerebellar Diameter
TD	Tissue Doppler
TI	Thermal Index
TIB	Tibia Length
TIB	Bone Thermal Index
TIC	Cranial Bone Thermal Index
TIS	Soft Tissue Thermal Index
TL Cine	Time Line Cine
TTD	Transverse Thoracic Diameter
TUI	Tomographic Ultrasound Imaging
TV	Tricuspid Valve
TVA	Tricuspid Valve Area
TV E/A	tricuspidal valve E/A ratio
T Vol	Thigh Volume

U

Abbreviation	Designation
UEA	Upper extremity atery
UEV	Upper extremity vein
ULNA	Ulna Length
ULNAR	Ulnar
ULNAR A	ulnar artery
UmbArt PI	umbillical artery pulsatility index
UmbArt RI	umbillical artery resistance index

V

Abbreviation	Designation
Va/Hem	anterior horn of lateral ventricle / hemisphere
Verteb	Vertebral
VCI	Volume Contrast Imaging
Vd	Velocity diastolic (= minimum velocity or end-diastolic velocity) (see also: ED and MD)
Vmax	maximum Velocity (see also: PS)
Vmean	mean Velocity
Vmin	minimum Velocity (see also: MD)
Vert. A.	Vertebral Artery
Vp/Hem	posterior horn of lateral ventricle / hemisphere

Abbreviation	Designation
VPD	Protodiastolic Velocity
VTD	Telediastolic Velocity
VTI	Velocity Time Integral

X

Abbreviation	Designation
XBeam CRI	CrossBeam Compound Resolution Imaging
XTD-View	XTD-View (Extended View)

Y

Abbreviation	Designation
YS	Yolk Sac

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GE imagination at work